The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XXX. March 3rd, 1934 No. 766

Notes and Comments

Chemical Industry and Armaments

THE suggestion which has been made by a Member of Parliament in a motion to prohibit the private manufacture of armaments sounds good, but it is well that the ultimate consequences should be visualised. Armaments are not used only for warfare. The same metallurgical processes enable us equally to make the sword and the ploughshare. A still more vivid illustration is the chemical industry. If the manufacture of materials of warfare were to be prohibited to the chemical industry many of the more useful activities of the chemist would be destroyed. There has been no greater lover of peace than Alfred Nobel, the centenary of whose birth occurred just before Christmas. The Nobel Peace Prize which he established is only a small part of his strenuous work for peace, and yet he was the man to whom we owe the development of high explosives. The vast explosive factories of the world which have resulted from Nobel's work are not engaged in making explosives for "the next war"; the peace-time uses for explosives are so great that the nations of the world have no need to keep munition factories equipped, idle, and waiting till they shall be needed. Where would industry be without explosives? The introduction of dynamite has entirely revolutionised the science of blasting and has made possible the execution of the great mining and engineering achievements of our time.

The Need for More Freedom

THE same argument applies to many of the other products of the chemical industry, including poison gas. Every chemical industry necessarily uses poisonous and dangerous materials in the normal course of trade processes, but that is no reason why irresponsible people should accuse them of producing these substances for the purpose of war and should seek to limit their activities in that direction. There is much to be said for the view put forward at the annual dinner of the Association of British Chemical Plant Manufactures that steps should be taken to keep public men better informed upon the activities and problems of industry. Having in mind the "gestures" this country has made in the direction of reduced armaments, there seems to be no impossibility in suggesting that one day the Parliamentary motion to which we have referred may be brought forward seriously. It may even be suggested that this country should cease to manufacture certain chemicals as yet another "gesture." Let us be careful never to obscure the fact that a strong chemical industry is a necessity for the waging of even the mildest defensive war. No country, and least of all Britain, can afford to allow the development of its chemical industry to be hampered by foolish restrictions, by obsolete laws, or by unfair foreign competition. In former days we framed our laws and our policy solely for the purpose of encouraging British trade and of increasing the wealth and power of the nation. It would be better if instead of discussing vaguely altruistic motions, Parliament were to devote itself to investigating the factors which to-day are still operating against the free development of industry, among which we would mention the patent laws and subsidised foreign competition.

Gas Cylinder Explosions

THE letter from Mr. Corr in THE CHEMICAL AGE last week referring to our note on the subject of gas cylinder explosions, appears to us to miss an essential point. Whilst the present type of cylinder is in use, his suggestion is entirely admirable that greater details as to safe methods of handling should be supplied with each cylinder. It must be remembered that the spread of education and the "tinkering" with motor cars and electrical toys has given rise to a large body of men, probably numbering millions, who in reality know nothing of the forces they handle, but who think they know a great deal. Such men are they who handle many of the cylinders supplied by the compressed gas manufacturer; probably they will never read the instructions, or if they should do so once, they will soon forget.

A recent legal action has shown that to supply goods with which the public can be injured is to render oneself liable to possible civil action for damages. How long will it be before the law holds that explosions of gas cylinders comes under this category? It is, in our opinion, advisable that makers of compressed gases should take every step that lies in their power to avoid serious consequencies resulting from the lack of knowledge of the users of their goods.

Industrial Research

SIR HUGO HIRST has stressed an important aspect of industrial research in his recent speech to the British Electrical and Allied Industries Research Association. He refused to answer the question whether or not it paid to have a research laboratory

purely in terms of accountant's figures. Those who have visited works as prospective purchasers of goods made therein, know that confidence in the firm is greatly enhanced by an obviously well-managed business; we are willing to believe that such a firm can be trusted to give us what we want. Even if their price is a little higher than that of a competitor, we come away prepared to pay more for what we believe will be a better article. We agree, therefore, wholeheartedly with Sir Hugo Hirst in his contention that " Research brings prestige; prestige brings confidence; confidence brings business."

Standard lines of manufacture are being produced more and more in each country; Britain, with its wealth of industrial experience, must expect to find one of her principal fields in the manufacture of those goods which require more than ordinary skill in production. Research may be window-dressing to some, but it is a vital necessity to others. On one occasion the late Sir William Hardy said to an applicant for a grant from the Royal Society: " I would rather try to get you £2,000 to carry out your research in the best way than £200 to carry it out in the second best way." That must be the spirit of British industry. The British Industries Fair is expected to show the extent to which many firms in this country are putting the correct precepts for industrial research into practice. The value of research, however, is not to be seen overnight; no firm can expect its research department to build up its reputation in a year or so. Those who wait until they find the immediate necessity for research will probably find that they have waited too long and have missed their opportunity. " Sooner or later," said Sir Hugo Hirst, " Saturation point will be reached in the home industry. We must have more export business. With the nationalist tendency of each country to exclude imports there is but one chance for us to increase our exports and that is by research and invention."

Research at Columbia University

WE referred in this column last week to the award of the Willard Gibbs Medal of the Chicago Section of the American Chemical Society to Professor Harold C. Urey, of Columbia University, for his discovery of " heavy water." Associated with Professor Urey in the discovery were Dr. George Murphy, of Columbia University, and Dr. F. G. Brickwedde, of the United States Bureau of Standards. Theoretical calculations on the boiling points of the light hydrogen gas and of the hydrogen gas containing one atom of the light hydrogen and one atom of the heavy hydrogen permolecule showed that distillation should be very efficient in separating the isotopes.

IT was Dr. Brickwedde who undertook to concentrate the hydrogen in this way. He shipped a sample to Dr. Murphy and Professor Urey, and this sample was investigated spectroscopically. A theory of the hydrogen atom due to Professor Nils Bohr, of Copenhagen, enabled these workers to predict exactly the spectrum of the heavy atom. According to Professor Urey, the reaction between hydrogen and iodine is being used at the Columbia University laboratory to investigate the affect of mass on extent of chemical reaction. He points out that the velocity of chemical reactions depends upon the mass of the atom, and we may expect chemical reactions using heavy hydrogen to be as much as three to five times slower than reactions using light hydrogen.

The Willard Gibbs Medal, founded by William A. Converse in 1911, was named for Josiah Willard Gibbs, professor of mathematical physics at Yale University, 1871-1903, who, although not primarily a chemist, did much to advance the science of chemistry. It is awarded annually by the Chicago Section, of the American Chemical Society to a scientist " whose work in either pure or applied science has received world-wide recognition," the award being determined by a national jury of scientists. The first Gibbs medallist was Svante Arrhenius, of Sweden. Other medallists include Mme. Marie Curie, of France; Sir James C. Irvine, of Scotland; Dr. Richard Willstaetter, of Munich; and among the Americans, Leo H. Baekeland, Ira Remsen, Moses Gomberg, Irving Langmuir, and Edward Curtis Franklin.

Jjanium (Fuss-Stuff)

NOW that, despite his youth, one of the claimants to a chief share in bringing the Knock More monster out of the waters has scored a medal, for services rendered to his Heaviness, let us hope the excitement will die down until something real is done with it. It is to be advertised internationally—as Wollywestium (?)—at Madrid, after Easter. There is no reason, in these days, to make so great a fuss over the birth of a new member even of the hydrogen clan. Being twice as heavy as the firstborn, the Rutherford school may find it worth their while to give the child special attenion, in their efforts to unravel the family constitution. Chemically, it is of no particular importance, merely a variant. When Purdie and Williamson introduced the paraffinic label CH_3 into sugars, they did special service, since extended by the Irvine-Haworth schools. They not only blocked hydroxylic hydrogen but so placed the methyls as to make them significant labels. The new hydrogen falls between the two schools, H and CH_3; it cannot serve as a label of place value, in any way comparable with that of methyl: it will simply do, in an inferior way, what methyl does so well. Chemists, too, owe a duty to society to refrain from making more compounds. The library at the Chemical Society is rapidly being crowded out by the combined attack of books like Mellor and Beilstein upon its shelves.

Deuthydrogen, in reality, is a radicle of no importance: in no way a radical. May it soon follow Mr. Lloyd George into proper retirement! As to name, Britannia cannot accept Deuterium even from Columbia. Nor can we follow Dr. Sidgwick's suggestion to symbolise it by a big D. The only possible reply is, D be D—d! Oxford chemists, unfortunately, will not take the lessons of the Oxford dictionary to heart. In honour of its true and first discoverer (Nature, February 24 p. 280), the adoption of the name *Jjanium* would seem not only appropriate but just; the discoverer of the Electron well deserves to have his initials, Jj., entered among the symbols of the elements. Some return is due to him for recovering such ashes from the United States.

Factory Effluents and Water Supplies

Annual Report of the Water Pollution Research Board

THE annual report of the Water Pollution Research Board, published by the Department of Scientific and Industrial Research (H.M. Stationery Office, 1s. net) draws attention to the fact that, although the water supplies of the country are, in general, much safer than those of some years ago, largely as a result of systematic research and the application of scientific methods, the need for even greater vigilance is occasionally emphasised by outbreaks of water-borne disease.

The work during the year under review to June 30, 1933, has shown steady progress. No new work has been begun, except an investigation into the effect of the discharge of crude sewage on the amount and hardness of the deposits in the estuary of the River Mersey, which is being conducted by the Department at the expense of local government and navigation authorities on Merseyside.

At the Rothamsted Experimental Station several hundred strains of bacteria, isolated from the percolating filters previously employed at the beet sugar factory at Colwick in experiments on the biological oxidation of beet sugar factory effluents, have been submitted to physiological examination. Laboratory experiments have also been made at Rothamsted to determine the effects of adding different quantities of compounds of nitrogen, phosphorus and potassium on the rate of oxidation of solutions of sucrose by means of percolating filters. Other work at Rothamsted has included experiments on the biological oxidation of cellulose, which is an important constituent of sewage and of certain trade wastes, and on methods of purification of effluents containing milk.

Experiments have been continued at the Department's Chemical Research Laboratory at Teddington on the base-exchange process of water softening and on the conditions affecting the plumbo-solvent action of water on service pipes. The summary of existing knowledge relating to the action of water on lead, to which reference was made in the last annual report, has been revised and enlarged and is to be published as Water Pollution Research Technical Paper No. 4. Further progress has also been made in the work at the London School of Hygiene on the activated sludge process of sewage treatment and in the investigation at University College, London, on the colloids of sewage and of beet sugar factory effluents.

Beet Sugar Factory Effluents

In the previous annual reports brief descriptions have been given of the results of an investigation begun in 1927 with the object of finding satisfactory methods of preventing or reducing the pollution of rivers by effluents from beet sugar factories. This investigation has included laboratory experiments at the Rothamsted Experimental Station and semi-commercial scale experiments at the beet sugar factory at Colwick, near Nottingham, where the necessary facilities were provided through the kindness of the Anglo-Scottish Beet Sugar Corporation, Ltd. From the results of the investigation during the three years 1927-1930, it was concluded that practicable methods had been devised whereby the excessive pollution of rivers previously caused by beet sugar factories could be avoided. By adopting suitable methods in the factory operations, the whole or the major portion of the waste waters can be satisfactorily re-used, and any portion which it is desired to discharge can be sufficiently purified by the process of biological oxidation on percolating filters. A comprehensive report on the work of the investigation and the results obtained during 1927-1930 has now been published as Water Pollution Research Technical Paper No. 3.

Since 1930, further experiments have been made in the laboratory and on a larger scale with the objects of improving the efficiency of purification of beet sugar factory effluents by biological filtration and of obtaining basic information likely to be of value in considering methods of treatment of other trade effluents and sewage. During the past year the physiological examination of the many strains of bacteria isolated from the percolating filters at the factory at Colwick has been continued. Additional experiments have also been made in the laboratory to determine the effect of adding different quantities of compounds of nitrogen, phosphorus and potassium on the rate of oxidation of solutions of sucrose in percolating filters.

In the last annual report reference was made to laboratory experiments carried out at the Rothamsted Experimental Station on the biological filtration of milk diluted with water to give a mixture containing 1.3 per cent. of milk. Although excellent rates of purification were readily obtained with gravel medium, the filter rapidly diminished in efficiency owing to the deposition of a thick spongy mass of film and consequent clogging of the upper sections. Wooden laths were then tried in place of graded gravel as the filtering medium. The lath filters were much slower in developing a high rate of purification but they showed less tendency to clogging.

Purification of Milk Wastes

During the last year laboratory experiments have been made to ascertain whether satisfactory purification of milk wastes can be effected by preliminary storage in a tank to separate fats and protein before biological filtration. It has been observed that during storage of the solution acid fermentation of the lactose first occurs, fat separates and casein is precipitated. At temperatures above 10° C. acid fermentation is well advanced in 24 hours and the biochemical oxygen demand of the separated liquid is only 40 to 50 per cent. of that of the original solution. As the acidity of the liquid increases the bacterial count decreases and owing to the separation of fat and casein the biochemical oxygen demand falls considerably during the first day. After the second day bacterial digestion causes marked increases in pH value, bacterial count and formol titration values and a small increase in biochemical oxygen demand. The minimum biochemical oxygen demand of the liquid is obtained after one or two days, provided the temperature is greater than 10° C., and there would appear to be no marked advantage from further storage if the liquid is to be submitted later to biological filtration. At temperatures below 10° C. the rate of fermentation decreases as the temperature is lowered until at 4° C. the solution remains practically unchanged for several days.

The preliminary investigation of methods of treatment of milk factory effluents has indicated that satisfactory purification of washings from churns and factory premises can be obtained by preliminary fermentation of the effluent followed by biological oxidation on suitable land or on percolating filters. Further experiments are required, however, to ascertain the conditions necessary for maximum efficiency of purification. The disposal of solid matter from the preliminary fermentation of the effluent and the treatment of wastes containing whey or other milk products also require investigation.

Biological Oxidation of Cellulose

Cellulose is an important constituent of the organic matter in domestic sewage and in certain trade wastes. It usually reaches the purification works as suspended matter in the sewage or waste. Preliminary sedimentation or precipitation can remove most of the cellulose as sludge but some remains in suspension and is carried forward to the next stage of the purification process. Anaerobic fermentation of sewage sludge yields considerably volumes of methane and carbon dioxide partly derived from the cellulose. In recent years anaerobic fermentation or digestion of sludge has been adopted at a large number of sewage works and in many instances the gas evolved is collected and used for the production of power and heat. In consequence, anaerobic fermentation of cellulose has been to some extent investigated, but very little is known about its aerobic fermentation in percolating filters or in the activated sludge or bio-aeration process.

During the past year preliminary laboratory experiments on the treatment of suspensions of cellulose by biological filtration and by the activated sludge process have been carried out at the Rothamsted Experimental Station. The cellulose used was finely divided wood pulp of good quality and containing 95 per cent. alpha-cellulose. It was mixed

with distilled water to give a suspension of 50 parts per 100,000, equivalent to 21 parts of carbon per 100,000, and the usual mineral salts together with phosphate and ammonium bicarbonate were added. Two experiments were made using the activated sludge process. In the first the amount of ammonium bicarbonate added to the suspension was such as to give a ratio of carbon to nitrogen of 9.6 to 1 and in the second a ratio of 94 to 1. An activated sludge was first prepared from crude sewage by aeration; this sludge was capable of nitrifying fresh sewage on aeration of the mixture for 24 hours. Portions of the mixture of sludge and sewage were then periodically withdrawn and replaced by suspensions of cellulose. The progress of purification was followed by determinations of the organic carbon content.

Erratic Experimental Results

From the results the rate of oxidation of cellulose under the conditions of these experiments appeared to be erratic. In some periods larger quantities of carbon were removed from the suspensions containing the higher proportion of added nitrogen and in other periods the reverse was found. Only traces of oxidised nitrogen were detected in the effluent from the treatment of suspensions containing carbon and nitrogen in the ratio 94 to 1 but in the effluents from the suspension with a ratio of carbon to nitrogen of 9.6 to 1 the total quantity of nitrogen as nitrite and nitrate was approximately one-fifth of the nitrogen supplied as ammonium bicarbonate. The amounts of carbon oxidised were of the order of only 30 to 40 per cent. It was also observed that the clarifying and nitrifying powers of the activated sludges deteriorated as the mixture of sewage and sludge initially used was gradually replaced by cellulose suspensions.

In experiments on the biological filtration of suspensions of 50 parts of cellulose per 100,000, two filters, each built in six sections and constructed entirely of glass, were employed. The filtering medium consisted of short pieces of glass tubing, 1.5 to 2 cm. in length and 1 to 1.2 cm. in diameter, and the rate of filtration was 100 gallons per day per cubic yard of filtering material. In the suspension supplied to one filter the ratio of carbon as cellulose to nitrogen as ammonium bicarbonate was 8.4 to 1 and the corresponding ratio in the suspension supplied to the second filter was 84 to 1. At the end of the experimental period, the first filter contained comparatively little film whereas large amounts of greyish white deposits were observed in the second filter, especially in the upper sections, and the filter was showing signs of clogging. It thus appears that with the smaller quantity of added nitrogen, cellulose was separated mechanically by the filtering medium more rapidly than it could be oxidised.

Water Softening Investigations

In previous work at the Department's Chemical Research Laboratory on the base-exchange process of water softening an attempt was made to find the effect of alteration of the rate of passage of the regenerating brine on the exchange values of two materials, representative of a treated mineral and of a synthetic product, the rate at which the hard water was passed through being kept constant. The first series of these experiments seemed to give reasonably concordant results but when the expriments were repeated under apparently similar conditions the second series of results were widely different from those first obtained.

A third series of experiments was then begun using the same apparatus as before, *viz.*, 6-inch diameter vessels which held one-tenth cu. ft. of material in a bed about 6 in. deep. The purpose was to find out whether there was any alteration in the base-exchange values after the materials had been in use for a long period under conditions which were kept as nearly as possible the same. Simultaneously a fourth series was begun in which the materials were used for one week and then set aside in the dark for two weeks; the same procedure was repeated a number of times. Regeneration of the materials used, Kenzelite, Natrolith and Doucil, was carried out by upward flow of 5 per cent. salt solution until one-tenth cu. ft. of effluent had been collected; the time occupied was, as nearly as possible, 20 minutes. This regeneration was immediately followed by the passing of hard water in the same direction at a rate equivalent to 70 gallons per hour per cu. ft. of material.

The results of these experiments when plotted against time, over the period of 168 days of the experiments showed some remarkable differences. With Kenzelite the fluctuations were much smaller than with the other materials, but even in this case the differences were greater than could be explained by errors of measurement and analysis. Calcium and magnesium in the hard water were determined by chemical analysis of daily average samples, and the soap test was used only to determine the point at which the treated water reached a hardness equivalent to 1 part of calcium carbonate per 100,000 and the material required regeneration.

Contamination of Water by Lead

In the last annual report it was mentioned that a summary of existing knowledge relating to the conditions affecting the plumbo-solvent action of water had been prepared with a view to publication. Certain additions have since been made to the first draft and in its revised and enlarged form the summary is to be published as Water Pollution Research Technical Paper No. 4. This paper, entitled "The Action of Water on Lead with Special Reference to the Supply of Drinking Water," deals with various aspects of the subject and includes sections on difficulties of dagnosis of plumbism, lead content of drinking water, protection of consumers from water plumbism, instances of lead in satisfactory use for long periods, analytical determination of lead, action of water on lead, electrolytic action, experimental technique, outbreaks of plumbism and protective measures adopted. The survey of the literature has revealed many divergent and frequently contradictory opinions regarding the effects of various conditions on the plumbo-solvent action of different waters and the amounts of lead which must not be exceeded in drinking water if risk of plumbism is to be avoided. It is therefore clear that a very large number of factors must be considered in a systematic experimental investigation of the subject.

During the past year laboratory experiments have been continued at the Department's Chemical Research Laboratory. Specimens of lead cleaned and prepared by different methods have been exposed under controlled conditions to the action of different waters contained in glass vessels, and the quantities of lead thereby dissolved and eroded have been determined. In addition, experiments have been made with lead pipes under conditions similar to those of a water supply service.

Gasworks Effluents

The Liquor Effluents and Ammonia Sub-Committee of the Institution of Gas Engineers has continued its investigations of methods of overcoming the difficulties associated with the disposal of liquor effluents from gasworks and of methods of recovery of ammonia from crude coal gas.

Four classes of substances in spent gas liquor are mainly responsible for its polluting character as measured by the test for oxygen absorbed from permanganate in four hours; these are phenols, higher tar acids, thiosulphates and thiocyanates. Phenols and higher tar acids are dissolved by the liquor from the tar with which it is usually condensed. It has been found that the quantity of higher tar acids in the liquor can be very considerably reduced by separation of the tar from the hot crude coal gas at a temperature above the dew point and before the ammonia liquor is allowed to condense. Monohydric phenols are more volatile than higher tar acids with the result that preliminary removal of tar from the hot gas reduces the phenols in the tar but increases the quantity in the liquor. Various methods have been proposed for the removal of phenols from the liquor; by one method the liquor is extracted with benzol from which the phenols are recovered either by distillation or by means of caustic soda.

Experiments on the biological oxidation of spent gas liquor as normally produced have shown that such liquor after a certain amount of dilution can be improved by treatment on percolating filters previously matured with sewage and mixtures of sewage and spent gas liquor. On the large scale this method has achieved a purification of 80 per cent. as measured by the oxygen absorbed from permanganate. The treated effluent, however, is still very polluting and may have an oxygen absorption value of the order of 100 parts per 100,000. Other experiments have shown that sewage containing as much as 1 per cent. of spent gas liquor by volume can in many cases be satisfactorily purified at the local sewage works.

Safety Precautions in Chemical Manufacture

A Need for Close Co-operation between Employees and Executive

SAFETY in industry, in-so-far as its special problems are involved, must not, and indeed, cannot depend on public opinion to provide the urge necessary for its preservation, said Mr. T. J. Dixon, B.Sc., of I.C.I. (General Chemicals), Ltd., at the commencement of his paper on "Safety Precautions in Chemical Manufacture," read before a joint meeting of the local section of the Society of Chemical Industry and the Chemical Engineering Group, at Liverpool, on February 23. It is true that public opinion, as voiced by the Factory Acts and the Statutory Orders made under these Acts, does regulate conditions of employment on such lines as to make the gross disregard of welfare and safety illegal, but these Acts and Orders inevitably contain only the elements of the safe operation of industry, and it must remain to each section of industry to devise its own methods of insuring the maximum of safety. Whilst each industry has its own special safety problems depending on the particular nature of the work carried no, it can equally be said that certain safety principles apply to all industries; and the putting into operation of these principles can only be successfully accomplished by the development of the proper attitude of mind in all those engaged, so that a form of "public opinion" is aroused inside the industry itself which will be alert for any slackness in observing existing regulations or in keeping abreast of developments which call for their extension or modification.

Advances in the Past 25 Years

The chemical industry is one in which manufacturing processes and the conditions under which these processes are operated, have, in the last twenty-five years or so, changed with extraordinary rapidity. Not only have processes changed, but new ones have arisen necessitating a complete revolution of ideas in the design and construction of chemical plants. Alongside these developments, accidents in the chemical industry have also steadily diminished both in frequency and severity. The reduction in accidents is ascribable to a wide number of causes, which includes the development of the right attitude of mind in regard to safety, better design and construction of plant, and improvement in the conditions under which chemical plants are operated.

After a visit to a *modern* chemical factory a very severe mental jerk is necessary to recall the impression which a visit to a corresponding factory twenty-five or thirty years ago would have left. At that time electricity in a chemical works was, to say the very least, an extreme rarity, as a source either of power or lighting. Power was supplied by steam engines, placed in the handiest position for the required belt drives without, usually, any regard for convenience of access either to themselves or to the machinery they drove. An apology for artificial lighting at night was sometimes made by the provision of gas jets, but speaking generally, a man had to carry with him an oil duck lamp to illuminate his way. Buildings can be said to have been installed only where absolutely necessary to cover the plant. A set of pyrites burners situated under low-built vitriol chambers provided working conditions, especially at night, which must really have been seen to be appreciated. Run-off cocks of acid tanks, stills, etc., were often placed in such positions that their normal operation definitely called for considerable agility on the part of the operator to avoid injury.

Spaciousness and Lighting

Perhaps the most striking features about a modern chemical plant, when compared with those of former years, are its spaciousness and lighting. And the influence which these two factors have on safety in plant operation is enormous. The provision of ample space in plant buildings enables a worker to concentrate on the job in hand, without having his attention distracted by the proximity of other operatives or, maybe, moving machinery. It enables ample head room to be provided, the lack of which can be responsible for so many accidents, both directly and indirectly. Stairways and access-ladders can be placed in the safest positions. Space can be provided for any loose tools or other articles which may have to be kept in the plant building; and definite walking ways, defined perhaps by white lines, can be laid out and kept entirely free from obstacles which cause stumbling and tripping accidents. Good ventilation is another desirable feature which is made easy by the provision of ample space in plant buildings. In certain chemical processes this may have a very direct bearing on the avoidance of accidents, and in any case the physiological effect of the atmosphere in which work is carried on has its influence, even though it may be indirect, on safety.

Efficient lighting, both natural and artificial, of plants and buildings, is obviously essential. Not only is it essential from the direct point of view of enabling a man to work at his own particular job and to move about the building in safety, but there are also the more indirect aspects to be considered. Good general illumination, as distinct from the local lighting of the more important points of a plant, may reveal incipient dangers which otherwise might pass undetected until too late. Further, good general lighting discourages untidiness, which can be the cause of so many minor accidents.

The Lay-out of the Works

The consideration, on safety grounds, of a works lay-out, is not peculiar to the chemical industry; although certain aspects, even from the point of view of the siting of the works itself, or of individual plants, apply particularly to the industry. The possibility of interaction between the products of entirely separate plants must always be considered from the safety point of view. For instance, a plant liberating sulphuretted hydrogen may be a dangerous neighbour to a plant manufacturing chlorates, owing to the risk of explosion through the agency of metallic sulphides. Another point, affecting the spacing of plant buildings is fire risk, with which is bound up the necessity for very careful thought being given to the siting of any plant which, in the event of fire, constitutes a special hazard, such as by the liberation of noxious or poisonous gases. The more general aspects of works lay-out involve, from the safety point of view, close consideration of such points as works entrances, where danger will occur in a large factory unless provision is made for control of vehicles, cyclists and pedestrians.

The first consideration given to the design of a plant for a new process is to ask what new hazards are connected with the process, and what knowledge is available to remove those hazards. The problem of plant design from the safety standpoint is, fortunately, simplified by the elementary fact that the plant which is best designed from the point of view of ease of operation and maintenance is also the safest. Thus, if in the design of a given plant, full consideration has been given to such points as ample spacing, plenty of head room, easy access to all operating points, and the provision of convenient means of carrying out maintenance work, it will usually be found that the design, as it stands, will satisfy safety requirements so far as actual operation is concerned.

Two Special Hazards

There are, however, two hazards connected with the chemical industry which involve "specialist" experience in the design of plant items, viz., the risk of failure of pressure vessels, and the risk of explosion. Pressure vessels provide a good instance of the way in which progress has enabled safety to proceed well in front of the dangers connected therewith. The knowledge now available regarding the various metals used in the fabrication of pressure vessels, together with the improvements which have taken place in the technique of construction (forging, welding and heat-treatment), make it possible to design and construct vessels, the reliability of which will be absolutely certain under any normal conditions which chemical processes have, up to the present time, demanded. In fact, it can be said that the failure of a pressure vessel in a chemical process, under normal conditions of operation, need *never* occur. Routine examination

and testing are, of course, essential to ensure the continued safety of any pressure vessel. In certain instances microscopic examination of samples of the metal cut from the walls of the vessels may be necessary, where there is reason to suspect chemical attack. Whilst there is little that can be said in a general way regarding the avoidance of explosion risks, since each plant where such risks may occur demand individual consideration, certain precautions can be adapted to many plants. For instance, simple "explosion boxes," consisting of vessels containing pebbles or similar material, placed in the gas mains of a plant, have proved very efficient in localising, and so minimising, the effect of explosions, the pressure generated escaping through a light "bursting disc" which forms the top of the box. The use of isolating valves, operated automatically by variations of pressure in the gas main, is another device which can, in certain cases, be of great help in reducing explosion risks.

Plant Maintenance

Electricity, which has been such a vital factor in the development of the chemical industry, is a wonderful servant, but also an extremely dangerous master. It so happens that many chemical processes provide the very conditions under which electricity can most easily become dangerous. Wet floors, where a man is sure of a good "earth" contact—an electric cable with its insulation damaged through a spill of acid—and the stage is set for a tragedy. There is, in fact, no place where electricity must be treated with more "respect" than in a chemical works. Workmanship, cables and fittings, used in an installation, must be of the very best. There should be regular routine examination of cables, switches and other parts of the installation; special attention being directed to earth connections, particularly in situations where corrosion is to be suspected. Portable appliances, and particularly hand lamps, should be kept under the very closest observation, and the use of low voltage (25 volt) hand lamps is a wise precaution.

Among other "services" which require special attention in a chemical works are the lifting appliances. The closest supervision of any manilla or hemp ropes, used for lifting purposes, must be made; it is not uncommon for such ropes to fail after being exposed to an atmosphere so slightly acid that it would never be suspected that the ropes could have been damaged. Regulations are in force governing the inspection and testing of lifting appliances in docks and wharves, and although, legally, these do not apply to chemical works, as such, similar regulations at least as stringent should be voluntarily adopted.

Electrical Risks

In connection with plant maintenance, as distinct from operation, mention must be made of the dangers attendant on the cleaning-out of plant vessels and storage containers. Fatalities have occurred through men entering vessels which had not been properly flushed out, owing to the presence of oxides of nitrogen, arsine, carbon monoxide and other poisonous gases. Wherever there is the possibility of the presence of poisonous gases in a vessel, the greatest care should be taken to ensure that conditions have been made safe before any man is allowed to enter for the purpose of repair or cleaning.

Model safety rules for use in chemical works have been compiled and issued by the Association of British Chemical Manufacturers. These publications consist of two volumes; the one, a small handbook containing general safety rules arranged for easy reference; and the other, a larger book containing more detailed instructions. These two books contain information and suggestions which are most valuable to anyone who is concerned with safety problems in the chemical industry. Further good work has been done by the Chemical and Allied Employers' Federation by the publication of information supplied by members of the Federation. The Department of Scientific and Industrial Research and the British Standards Institution have also contributed to safety in manufacture. The recommendations of the Gas Cylinders Research Committee and the Committee on Welded Containers of the D.S.I.R. have placed the design and fabrication of vessels to contain compressed and liquefied gases on such lines as ensure the absolute safety of such vessels under normal conditions of use. The B.S.I. is, of course, always contributing to safety, either directly or indirectly, but as an instance of purely safety work the standards relating to the identification of chemical pipe lines, and gas cylinders by means of colour schemes, may be quoted.

Safety handbooks are compiled by Imperial Chemical Industries, Ltd., for each group of their activities, explaining any special hazards which may be involved and containing definite instructions, both general and special, regarding safety measures which must be observed. Each of these handbooks is prefaced by forewords written by the chairman and managing director of the particular group concerned, setting forth the reasons for issuing the handbook, and emphasising the extreme importance of the observance of the instructions and advice contained therein, and a copy is given to every worker employed. In every works there is also a "safety committee" composed of members of the staff, foremen, and workers, whose duty it is to keep a watchful eye on all matters relating to safety in the works; to point out dangers which from time to time come to light; to report any non-observance of safety rules; and to receive and consider safety suggestions which all workers are encouraged to make. Publicity is also given to the statistics which are compiled relating to accident frequency, and curves showing the rise and fall of frequency rates are displayed in prominent places, so that a healthy rivalry is established between various departments in competition for the lowest accident figures.

Coming International Congresses

Meetings in Paris and Madrid

THE third Technical and Chemical International Congress of the Agricultural Industries will be held in Paris from March 26 to 31, under the presidency of H.E. the Sénateur Ferdinand David. The work of the Congress will be divided into five groups as follows:—(1) Scientific and economic studies, including determination of *pH* and of the *rH*; water pollution, employment for new purposes, alimentary or otherwise, of agricultural goods produced in excess, and improvement of the sugar beet and sugar cane by genetic selection; (2) sugar manufacture, including clarification of sugar juices; crystallisation and conservation of sugar; (3) fermentation industries, including study of fermentations; continued diffusion, and the unfermented wine industry; (4) alimentary industries, including qualities required in bread in different countries, properties of flour and wheat; equipment used in the vegetable oil industry; use of vegetable oils in motors; collection, transport and treatment of milk, and the manufacture of chocolate, and (5) allied industries, including study of fuels based on alcohol and on their use, and wood distillation.

Subscriptions to the Congress are 100 francs for ordinary members, 500 francs for "membres donateurs," and 5,000 francs for "membres bienfaiteurs." Families of members may become associate members on payment of 50 francs per member, and a society, or a group of people, may become a "membre donateur," and as such has the right to appoint three delegates.

At the conclusion of the Congress, a tour through the wine-growing districts in France will be arranged in such a way that those members attending the ninth International Congress in Madrid will arrive in that city on April 5. Further particulars and forms of application can be obtained from Mr. S. E. Carr, Chemical Society, Burlington House, London, W.1. Those desiring to attend the congress should apply at once to the Secretary, Third Congrès International Technique et Chimique des Industries Agricoles, 156 Boulecard Magenta, Paris.

The eleventh conference of the Union Internationale de Chimie will be held at Madrid at the same time as the ninth International Congress of Pure and Applied Chemistry. Among the matters to be considered by the various commissions of the Union are the reforms of inorganic, organic, and biochemical nomenclature; physico-chemical standards; co-ordination of scientific terminology; international tables of constants, and finance. The election of president and vice-presidents, and the nomination of members of commissions, will take place on April 11.

Industrial Wastes—III.

Some Modern Methods of Treatment

THE waste at glue and gelatine works results almost entirely from the liming process adopted for the removal of hair from animal scrap, i.e., hide, heads and hoofs. This waste is highly charged with lime, hair and small fragments of flesh and hide, and is decidedly odorous, whilst the colour is usually a dirty milky-white. In addition there is an accumulation of dirt, hair and blood removed in washing the glue-making stock. The approved method of treatment consists in passing the waste through a fine rotary screen for the removal of the hair and fragments of animal matter (40 to 55 per cent.), subsequently clarifying the liquid portion in a continuous settling tank. The clarified effluent can be then discharged to stream or sewer without further treatment. The sludge which accumulates in the settling tank is very voluminous and carries from 85 to 92 per cent. of moisture. It is usually dumped on waste land, but it can be dewatered without difficulty on a continuous vacuum filter owing to its high lime content. The resulting filter cake (60 to 65 per cent. moisture) is then dried and ground for direct sale as a fertiliser, or mixed with basic slag, superphosphate, etc., to make compound fertilisers. To dry the filter cake it is spread on fine wire netting and exposed in a sealed stove, care being exercised to prevent overheating as the dry product is liable to burst into flame.

Meat and Fish Packing Industry

Waste from the slaughter and subsequent dressing for market of cattle, sheep and pigs is composed of hair, flesh, blood, paunch, grease and fat, together with floor sweepings. It is highly odorous and putrescible, and cannot be treated at municipal sewage works, as grease and paunch interfere with plant operations. Such waste is obtained in the meat packing industry, and also to a lesser degree in the large scale manufacture of sausages, potted meats, etc. Treatment includes the skimming of tanks for the removal of grease; fine screening on rotary screens for the removal of solid matter, hair, etc.; the addition of lime and alum (with intimate mixing) for the precipitation of fine solids, which are removed in continuous settling tanks. The effluent is then ready to be discharged to the sewer. Grease collected in the skimming tanks is marketable as an inedible fat, its oxygen consuming power being 80 to 180 parts per million. Screenings carry 80 to 85 per cent. of moisture and may amount to anything from 5,000 to 15,000 lb. (calculated on a wet basis) per million gallons of waste; they may be decomposed in steam-heated digestion tanks, or reduced in moisture by vacuum filtration and subsequent drying for use as fertiliser or admixture with pig food. The sludge collected in the settling tanks contain 92 to 96 per cent. of moisture and may amount to 45,000 gallons per million gallons of waste; by vacuum filtration the moisture content can be reduced to about 75 per cent. Biological treatment, with aeration tanks or trickling filters, has also been adopted to give a higher degree of purification; chlorination is another alternative. Complete oxidation is said to be obtained in aeration tanks, as used in the activated sludge process, with 3 to 5 cubic feet of air per gallon of waste and an aeration period of 8 to 12 hours.

At one large packing house the heavy suspended solids, mixed with condenser water, are removed by clarifier mechanism and the partially clarified effluent is treated with chlorine, passed into a second settling tank also equipped with clarifier mechanism to remove the remaining suspended solids and scum, and thence to stream or sewer. The sludge pumped from the primary and secondary settling tanks is treated with ferric chloride, with or without lime as conditioning agent, and dewatered on a vacuum filter. The resulting filter cake is then dried and ground for use as a fertiliser.

About 50 per cent. of the fish waste in England is manufactured into fish meal. The sorting of offal from oily fish and white fish is desirable for the best product. The chopped offal is passed through steam-jacketed digesters and cooked for 15 to 20 minutes at 105°, then dried at 60° in dryers equipped with agitating gear. After cooling, the sterilised waste is ground and graded. Gases from the digesters and driers are withdrawn by means of exhaust fans and scrubbed with water by passage through towers; the remaining fumes are then chlorinated and discharged to the atmosphere. The burning of the gas is not advocated, as objectionable odours are produced.

Fruit and Vegetable Canning

Waste water from fruit and vegetable canning plant carries a large amount of skins, pods, peelings, stalks and other vegetable fibre, together with fruit juices and colouring matter. The greater part of the suspended solids can be removed by screening, or by passage through dewatering cones followed by rotary screens, but the screened liquid still contains appreciable amounts of matter—dissolved and suspended—which is of a putrescible nature; in some cases, as with tomatoes, it may be highly coloured. Subsequent treatment may be chemical or biological. In the first case, the screened liquid is mixed with lime and ferrous sulphate and passed to a continuous settling tank. The clear effluent is then ready for discharge to stream or sewer, whilst the sludge and screenings are dried on sand-beds or cinder-beds prior to burning. At one factory precipitation and coagulation is effected by the addition of 2 to 3 lb. of lime and 0.5 lb. of sodium aluminate per 1,000 gallons of screened waste. For biological treatment the screened waste is clarified in a continuous settling tank without the addition of chemicals, and then passed to sand, sinder or trickling filters, from which the clear effluent is discharged to stream or sewer. Screenings and sludge are digested in a covered tank, and the digested solids are dried on cinder-beds

Screening by aid of wire screens having 20 to 40 mesh per inch is a necessary preliminary treatment for all canning wastes; about 40 square feet of effective screen area is said to be ample for a cannery discharging 100,000 gallons of water per day of 12 hours, when the screenings will average 80 cubic feet. Trickling filters have proved to be very effective in the treatment of the screened waste at canneries where the rate of filtration is less than 500,000 gallons per day and the final dilution is not greater than 1 to 5. Chemical precipitation with 7 to 10 lb. of lime and 3 to 5 lb. of ferrous sulphate has been adopted when the final dilution is greater than 1 to 25. Final chlorination of the effluent from the filters or settling tanks modifies the nature of the organic matter and is equivalent to the removal of about 30 per cent. of the residual unstable organic matter. The required dose varies from 8 to 30 parts of chlorine per million parts of effluent depending upon the degree of preliminary treatment, as a residual chlorine content of at least 0.5 parts per million is desirable in the effluent passed to a stream.

The average waste from pea canning operations has a pH value of 4.9 and an average oxygen consuming demand of 1,500 parts per million. Successful treatment includes screening, followed by precipitation with lime at ferrous sulphate, or oxidation on trickling filters, with chlorination of the final effluent. Stock liquor may require individual treatment before mixing with the main volume of waste water composed of cold wash, blancher discharge and floor wash, as it has a 5-day oxygen consuming demand of 35,000 to 40,000 parts per million; here a reduction of 83 per cent. in the oxygen demand can be procured by adding 100 lb. of lime to each 1,000 gallons of liquor.

Beet Sugar Factories

Beet sugar factory effluents comprise beet wash water with mud, leaves, beet tops and tailings, and a small percentage of soluble organic matter; pulp or diffusion water, which carries a small amount of suspended organic matter, sugar and mineral matter in solution; calcium carbonate and organic matter from the purification of the beet juices (lime sludge); and "Steffens water," which contains all the mother liquor remaining after the sugar has been precipitated. The water used for carrying and washing the beet is by far the largest bulk, amounting to about 4,000,000 gallons per day

for each 1,000 tons of beet. Diffusion water, which has been used for washing the diffusion apparatus and has been pressed from the exhausted pulp, amounts to about 600,000 gallons per day; the lime sludge, which is usually mixed with sufficient water to facilitate pumping, will be about 150,000 gallons per day; and the Steffens water, which has an oxygen consuming power of 4,000 to 6,000 parts per million, amounts to just over 200,000 gallons per day, all these figures being per 1,000 tons of beet.

The beet wash water can be screened to remove suspended matter and can then be treated with lime and returned to the water may also be treated with lime and returned to the process. The lime sludge can be passed through a settling tank, ultimately utilising the precipitated lime for land treatment. The disposal of the Steffens water, however, is more difficult; it contains about 3 per cent. of solid matter, of which two-thirds is organic, and will rapidly putrefy during warm weather.

The general principles adopted for dealing with these large volumes of waste water include sedimentation in ponds; chemical treatment with lime and ferrous sulphate; the use of trickling filters and other forms of biological purification; and distinct separation of the various types of water with subsequent treatment and filtration, where possible, for further use in the factory. A series of separate retaining ponds is usually provided for the pulp water and lime sludge, with the overflow arranged over shallow riffles between the ponds. In the United States the Steffens water has been used as a source of potash, 20 per cent. of it being returned direct to the soil as factory sewage, 10 per cent. being concentrated to 50 per cent. dry substance or calcined to give crude ash, and the balance of 70 per cent. discharged to the stream. In Germany this waste has been concentrated and used in the production of potassium cyanide and ammonium sulphate. Some progress has also been made in utilising it for the production of such products as glutamic acid and betaine.

Starch Manufacture

With methods for recovering by-products in the manufacture of starch, fully 95 to 98 per cent. of the corn substance is now utilised. The chief wastes are steep water; the overflow from the starch settlers, gluten settlers, and feed press settlers; and condenser water. With the exception of condenser water, these wastes contain sulphurous acid and can be approximately sterile, but as they carry large amounts of nitrogenous matter, proteins and carbohydrates, they are favourable for fermentation to set in when diluted by river water. The addition of milk of lime gives a clear non-offensive effluent, but a more profitable utilisation has been effected by using the settler overflow for steeping the corn, and ultimately concentrating the steep water and drying it, in admixture with the hull of the corn, for use as a feeding stuff.

Spent Acid from Metal Pickling

Waste liquors from metal pickling vats contain sulphuric acid, ferrous sulphate, scale and dirt, diluted by water used for cooling purposes; at some works hydrochloric acid is used in place of sulphuric acid. The free sulphuric acid content may be high, with even as much as 6 to 8 per cent. of iron (30 to 40 per cent. $FeSO_4.7H_2O$) in solution. Treatment with lime produces a gelatinous sludge of ferric hydroxide and calcium sulphate which is sometimes difficult to handle and is also worthless. It is said that an average of 30 lb. of lime is required per 1,000 gallons of waste, and that where the process is successful the sludge from the continuous settling tank carries about 85 per cent. of moisture, on a wet basis amounting to about 6 gallons per 1,000 gallons of waste. The addition of scrap iron will remove excess sulphuric acid from the raw waste, and the liquor can then be concentrated by evaporation in lead-lined tanks heated by waste steam, the "copperas" being recovered by crystallisation on cooling.

At some American mills spent pickling liquor is concentrated to sp.gr.1.40 in a horizontal tube evaporator, finding direct sale as "black liquor" for use as a mordant in textile dyeing and calico printing. The market for copperas and black liquor, however, is limited, and it may be more economical to cool the spent pickle liquor by refrigeration, without neutralising it with scrap iron, the recovered copperas crystals being sold whilst the mother liquor is returned to the pickling vats. At 0°C. from 1.85 to 2.2 lb. of copperas are retained in solution per gallon of spent pickle liquor, as the acid content varies from 2 to 5.7 per cent., but at 20°C. the range of solubility is 3.25 to 3.7 lb. per gallon.

Oil and Grease Recovery

Waste "cutting fluids" from the machine shops at large engineering works consist of an oily medium and emulsifying agent, and therefore require treatment before the oil can be recovered. The addition of aluminium sulphate will destroy the emulsion and the oil is then separated from the water by passage through a centrifuge. The resulting precipitate of aluminium hydroxide is removed by filtration through sand. Lime is added to the filtrate to keep it at a pH value of 6 to 8 for passage to the sewer.

Considerable quantities of fat are liable to be lost in kieselguhr residues from the so-called "fat hardening" processes; these residues may be regarded as waste after the removal of the nickel. They amount to about 4 per cent. of the weight of oil which has been hardened, and the associated fat cannot be recovered by melting. Treatment with hot caustic lye (sp.gr.1.05) will saponify 70 per cent. of this fat, permitting its recovery as soap. Another fat recovery problem is presented in the disposal of garbage. This refuse comprises waste vegetable matter, straw, sawdust, paper and other packing materials, offal from butchers' shops, fish trimmings, waste from restaurants, etc. Tankage, suitable for use as a fertiliser has been obtained by treating the garbage with steam under pressure, the water and some of the grease being removed by pressing, whilst further quantities of grease are removed by solvent extraction; it contains 3 to 4 per cent. ammonia, from 2 to 5 per cent. phosphoric acid, and up to 1 per cent. potash.

Another industrial oily waste consists of the contaminated water from the separators and scrubbers of water gas plant. Not only is this waste offensive in odour, but it also gives rise to a tarry scum if discharged to a stream. The emulsified tar and oil may be separated from the water by the addition of lime and ferrous sulphate in a tank provided with agitating gear, followed by passage through a continuous settling tank which is provided with an oil skimming device. The sludge amounts to about 4 per cent. of the raw waste by volume, and contains 85 to 90 per cent. of water by weight; it can be further reduced in volume by dewatering on a continuous vacuum filter.

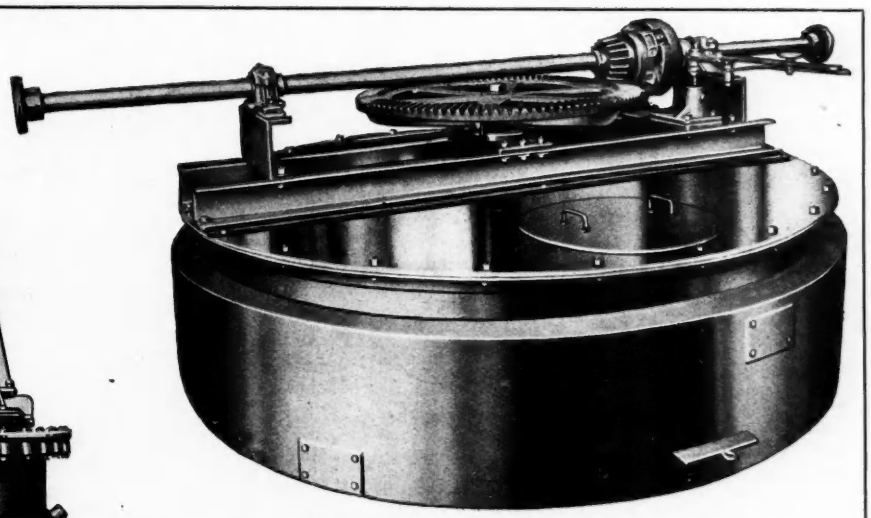
The Forthcoming "Achema"

Preparations at Cologne

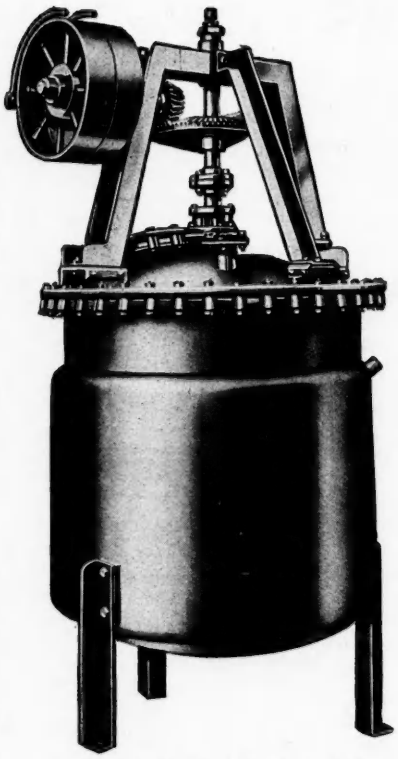
THE 1934 Achema will be held in Cologne from May 18 to 27. The three halls provided for the exhibition will occupy a space of 190,000 sq ft., most of which has already been booked by leading firms in the chemical equipment industry. The "Staatenhaus" situated close to the exhibition halls will be arranged as lecture rooms, as in addition to the Achema exhibition, the Congress of the German Chemical Trades' Association consisting of seventeen special groups, and those of three allied associations, will be held simultaneously. Not only the German Chemical Trades' Association, but also the "Dechema" Deutsche Normenausschub E.V., Kolner Bezirksverein Deutscher Ingenieure E.V., Verband Deutscher Apparatebau-Anstalten E.V., Verband für autogene Metallbearbeitung, Verein Deutscher Eisengiebereien. Verein Deutscher Kupferschmiedereien, Vereinigung der Deutschen Dampfkessel-und Apparate-Industrie E.V., and other scientific and technical associations will hold conferences during the exhibition.

THE Cia. Argentina de pesca, Buenos Aires, produced 4,957 metric tons of whale guano and meal during the year ended June 30, 1933, a gain of 600 tons over the previous year. An agreement with other whale-oil producers will necessitate curtailment in 1933-34. The company will operate its factory at Grytviken, South Georgia, while the floating factory will be used solely for transporting supplies and products.

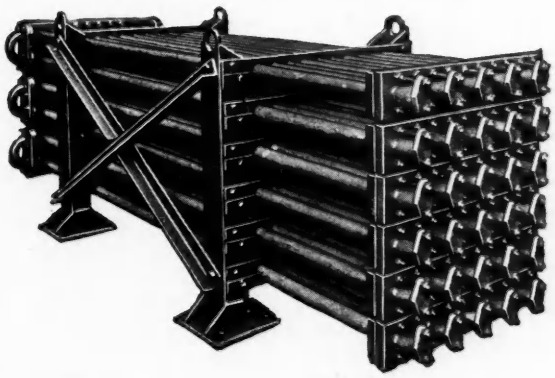
Welded Steel Plant of British Manufacture



Mild Steel Jacketed Pan, 7 ft. 6 in. diameter × 20 in. deep, with Friction Clutch Gearing and Cast Iron Crown and Bevel Wheels.

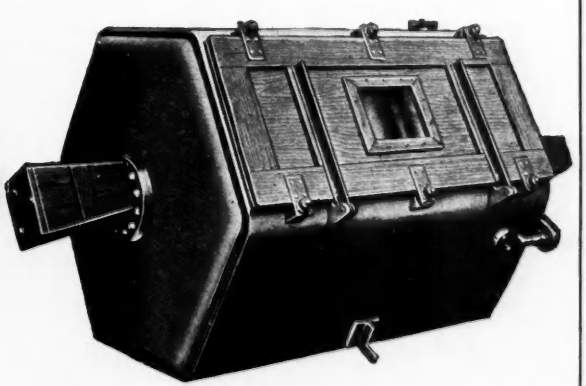


A Typical Glass Enamelled Jacketed Mixer.



High Velocity Heat Exchanger for Hot Viscous Vegetable Oils, constructed throughout of stainless steel. Supplied for cooling one ton of oil per hour from 300° to 90 C. and heating a similar quantity from 56° to 260 C.

Welded Steel Benzol Rectification Still, 6 ft. 2 in. diameter × 8 ft. between end flanges. Working pressure, 50 lb. per sq. in.



Cellulose Xanthate Jacketed Churn, as used in the Art Silk Industry

Reproduced by Courtsey of Robert Jenkins & Co. Ltd.

Letters to the Editor

Mustard Gas

SIR,—For my sins I had the task of breaking down the largest accumulation of poison gas in the world (100,000 tons of gas shells). I dealt with poison gases manufactured by all the larger nations engaged in the late war. I saw Major Freeth's statement in the daily Press and, strange as it may seem, I am in substantial agreement with him on the point of non-danger of poison gas.

Mustard gas is particularly easy to deal with and with methods evolved in my dumps in France (particulars of which I believe have never been published) it would be a simple matter to clear the streets of London of mustard gas. "Another Peacelover" would appear to have missed the point when he seeks to compare the "toxicity of phosgene and mustard gas with hydrogen sulphide, etc." Mustard gas is not a toxic gas in the ordinary sense of the word. It is a vesicant liquid which lies about the ground for weeks and will inflict the most venomous and dangerous burns, which almost invariably become septic. The ordinary method of sterilising ground impregnated with mustard gas during the war was to neutralise it with chloride of lime. Unfortunately, it takes about ten times its weight of chloride of lime to neutralise a given quantity of mustard gas; but modern methods have been evolved that would clear the streets in a matter of hours.

What has astonished me in all discussions I have read of the effects of a poison gas raid on, say, London, is that people whom one could presume to know their subject ignore entirely the mental or moral effect of poison gas on defenceless people. I suppose no individual handled more poison gas than I did in my dumps in France and Belgium, and yet I never overcame a dreadful feeling of panic, which crept over me whenever I smelt poison gas, even though I might know it was diluted to below the danger line, *unless I had a gas mask in my possession.* I made many inquiries and found that almost without exception all my employees felt the same way. The panic is a sort of hysteria and makes one want to rush blindly about. In my case the feeling passed off immediately I donned my gas mask.

Replying to "Another Peacelover's" inquiry as to where he could obtain up-to-date respirators, I would refer him to Siebe, Gorman and Co., Ltd. It should be possible to design a respirator for civilians who could be expected not to indulge in strenuous exercises during a gas raid, at a fraction of the cost of the Army pattern. For treatment of poison gas cases he should refer to Dr. David Thomson, of the Pickett-Thomson Research Laboratory, Endell Street, London, who published particulars of the successful methods used in my dumps. I believe Dr. Thomson could be persuaded to re-print these particulars.

I understand that the Governments of France and Russia are equipping their civilian population with gas masks and rubber boots and gloves (the latter against mustard gas).

It is my conviction that some steps should be taken in this country to educate people to the fact that poison gas *per se* is not likely to be dangerous to them if they can control their panic. For those who cannot, a cheap gas mask, rubber boots and clothing ought to be available.—Yours faithfully,

F. N. PICKETT.

147 Grosvenor Road, S.W.1.

Mysore Sandalwood Oil

UNTIL within the last few years, most of the sandalwood oil distilled in the State factory of Mysore found a ready and profitable market in France, England, Japan, and other countries. In the past three or four years, however, a steady decline in exports was registered as a result of general depression and the competition which the State oil had had to meet from Germany which produced a synthetic oil and also from Australia. Consequently there was a marked fall in exports to Japan. In order to meet this new condition, the Government of Mysore State has opened an office in Tokyo to extend the sales of sandalwood oil in Japan, and it has been possible to bring the Mysore oil within the reasonable reach of the actual consumer by a reduction of prices and by the necessary propaganda.

South Staffordshire Mond Gas Co.

Exploring Low Temperature Carbonisation

THE thirty-third ordinary meeting of the South Staffordshire Mond Gas Co. was held at Dudley Port, Tipton, on February 19, when the chairman, Mr. Emile Mond, said that the revenue and profit and loss accounts for the year showed a gross profit of £20,921. After paying debenture stock interest there was a balance of £8,004 available for preference dividend, and a proposal would be made for payment of the preference dividend for the year 1931. This would leave two years' arrears of preference dividend outstanding.

Mr. Mond pointed out that gas sales showed an increase of 11 per cent., and sulphate of ammonia an increase of 22 per cent., compared with the previous year. The sales of paints and wood preservatives bitumens have continued satisfactory, and a new range of high-grade enamel paints would shortly be placed on the market. Mr. Mond also informed the meeting that three scientific developments had been exercising the very close attention of the Board for some time. These were low temperature carbonisation; the manufacture of fuel oil from coal by the hydrogenation process; compressed gas. The only development which was likely to prove of advantage to the company was that of low temperature carbonisation, the possibilities of which were being thoroughly explored. He concluded by saying that the prospects of the company could now be envisaged with a greater measure of optimism than could have been justified by the long period of trade depression which had almost paralysed the industrial activity of this country.

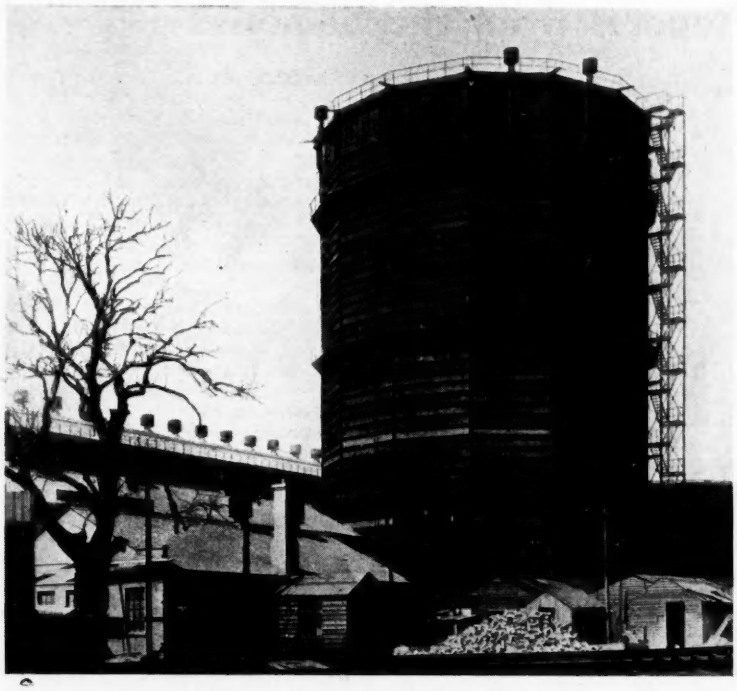
Borax Consolidated, Ltd.

A Steady Improvement Reported

SPEAKING at the thirty-sixth ordinary general meeting of Borax Consolidated, Ltd., held in London, on February 21, the chairman, the Earl of Leven and Melville, said that the company has succeeded in showing an improvement over the previous year. In 1929 the collapse in the United States occurred, accompanied by a drop in the prices of borax and boric acid, due to competitive action, also with a substantial reduction in the demand. In 1928 and 1929 very serious reductions in the price of borax were also made by the competition in European countries. In the early part of 1932 competitors in the United States further reduced the price of borax in that country by about 24 per cent. and of boric acid by about 33 per cent., thus reduring them to an unremunerative level. The drop in the prices of borax and boric acid between 1928 and 1932 amounted to more than 40 per cent. Nevertheless, the company has shown a gradual improvement in their net profit largely due to the reduction in cost prices, for in 1929 they had a net profit of only £160,624, in 1930, £163,447, in 1931, £188,249, in 1932, £200,787, and this past year, £209,422.

The Potash Co., in which Borax Consolidated, Ltd., has a large investment, is now in the profit-earning stage, and has operated most successfully during the past year. During the past few months there have been encouraging signs of an improvement in the demand for the company's goods in the United States and in Europe The low prices to which borax and boric acid have been forced by over-production and competitive action are much below pre-war levels everywhere, and especially so in the United States, where they have been forced down to unremunerative levels, with a consequent bankrupt condition to some concerns producing borax.

THE demand for methanol in Japan has increased to such an extent during the past two years that efforts are being made to produce it synthetically. Three large companies, with adequate financial backing, have built plants to produce synthetic methanol; one is actually manufacturing this product at present, and the other two concerns expect to place their products on the market during the next few months. Imports of methanol into Japan during the 3-year period 1929-1931 averaged about 2,200 long tons annually. During 1932, imports increased to 4,083 tons, and imports for the first 10 months of 1933 indicate that this total will be even higher.



Waterless Gasholder (M.A.N. Patents)
Imperial Chemical Industries Ltd., Billingham.

There is no substitute for experience

Synthetic chemicals are being discovered for many good old-fashioned commodities, but there never can be any substitute for experience; the supply is limited.

Modernised works covering 17 acres; the best of equipment kept constantly up-to-date; a central location and excellent rail facilities; a record of over 70 years of successful work for our industrial friends; a sound financial structure guaranteeing our responsibility; all these have resulted from the experience of our organisation and are at your disposal.

CLAYTON, SON & Co., Ltd.

MANUFACTURERS OF

- Chemical Plant
- Gasholders
- Oil Refining Plant
- Tanks
- Steam Boilers
- Plate work of every description
- Pipes and Gas Mains

All Enquiries to

MOOR END WORKS, HUNSLET

Telegrams: GAS, LEEDS — **LEEDS** — Telephone: HUNSLET 75226

London Office: 5 VICTORIA STREET, S.W.1

CLAYTON SON & CO., LTD.
CHEMICAL PLANT MAKERS FOR OVER 70 YEARS

Notes and Reports from the Societies

Chemical Engineering Group

THE next meeting of the Chemical Engineering Group will be held jointly with the Road and Building Materials Group of the Society of Chemical Industry, and the Institution of Structural Engineers, on Friday, March 9, at 8 p.m., in the refectory of Imperial Chemical House, Millbank, S.W.1, when a paper on "Some Trends of Development in Building Materials" will be read by Major V. Lefebure, B.Sc., A.I.C., and Mr. A. H. Douglas, M.I.Struct.E., A.M.Inst.C.E. The chairman of the Group, Mr. W. A. S. Calder, will preside. The authors will contrast, with regard to certain building materials, the promise that the original specification with the performance in the finished building. They illustrate the problem by means of a detailed consideration of a typical building treatment, namely the internal partition.

British Wood Preserving Association

Coal Tar Creosote as a Wood Preservative

COAL tar creosote oil as a wood preservative was the subject of a paper which Mr. N. A. Richardson, B.Sc., A.I.C., of the Forest Products Research Laboratory, read before the British Wood Preserving Association, on February 21.

The most important and desirable qualities of a wood preservative, said Mr. Richardson, can be included under three headings: (1)) It must possess toxicity or killing power towards wood destroying agencies, such as fungi, and insects; (2) it must possess a high degree of permanence; and (3) it must have good penetrating power. All of these properties can only be taken into account in one test by means of an actual service test which unfortunately takes a very long time to complete. Efforts have, therefore, been made to obtain indications of these properties by means of accelerated laboratory tests, and as far as creosote is concerned the majority of these have concerned the measurement of the toxicity of the preservative towards specific wood destroying fungi.

The toxicity of a number of different creosotes have been determined at the Forest Products Research Laboratory, Princes Risborough by means of the standard ager and wood block methods. These include various creosotes or distillates prepared from tars obtained from horizontal retorts, vertical retorts, blast furnaces, and low temperature carbonisation (coalite) process. The results show that all the oils are highly toxic to wood destroying fungi and that there is very little to choose between them as far as toxicity is concerned. In an agar medium from 0.02—0.32 per cent. of creosote prevented the growth of fungi, the variation depending mainly on the fungus used. It may be thought that the physical properties of a substance which govern its permanence could also be determined in the laboratory, but unfortunately up to the present this has not been the case. In fact, the only completely satisfactory test of a preservative must take the form of a field test in which specimens treated and untreated are exposed under identical conditions.

About the time of the late Sir Samuel Boulton delivered his now classic lecture before the Institution of Civil Engineers, in 1884, the explanations of the efficiencies of creosote as a wood preservative were included under three headings:—(1) It coagulated the albumen contained in the wood; (2) it rendered the wood more or less waterproof, by plugging the wood cells with a solid material; and (3) it stopped fermentation. Soon afterwards, it was shown that neither the first, nor the last of these offered a true explanation, but Mr. Richardson said he was quite certain that the second is definitely one of the properties which contributes to the effectiveness of creosote oil as a wood preservative.

Mr. Bryan (Forest Products Research Laboratory) said that efforts were being made continuously to develop an accelerated test for preservatives, but it was no use putting forward such a test if it were open to doubt; so that it must be definite before it was put forward. There were so many factors entering into the action of a wood preservative that it was doubtful whether the effects produced in an accelerated test would be the same as in a service test. For instance, leaching occurred from the outside surface, leaving a low concentration in the outer layers, but the preservative in the interior of the wood did not immediately rush to the outside in order to maintain the concentration there; the diffusion occupied a considerable time, and he did not think it could be accelerated. Other factors were volatility and the effects of the weather—the ultra-violet light in the sunlight might have an effect. In an accelerated test all these factors must be taken into consideration together, and not only separately, and such a test would be complicated.

Mr. Richardson, referring to the analyses of creosote residues from old timbers, said there was a striking difference between those and the analyses of normal creosotes made to-day; the results seemed to indicate that some of the lighter oils which had disappeared must have been very much more toxic than those remaining in the residues. He did not think that, if wood were treated with the residues, it would last as long as if the original creosotes were applied; one could not really say that the oils remaining in the residues were those which had preserved the wood for 50 years, and if the poles had remained longer in the ground, decay might have occurred. Piling treated with creosote had a relatively shorter life than telegraph poles or sleepers; the pile remained immune from attack for a long period, and then decay occurred suddenly, which indicated that there was something in the preservative which, while it remained, kept the decay at bay.

Mr. Ferguson said it had been found that if there were more than 50 per cent. of non-toxic petroleum oils in the mixtures the preservative properties were reduced very considerably.

The Faraday Society

Determination and Interpretation of Dipole Moments

THE Faraday Society will hold a general discussion on the determination and interpretation of dipole moments at Exeter College, Oxford, April 12-14. According to the provisional arrangements for this meeting, the subject will be introduced by Professor P. Debye, of Leipzig. The determination aspect will include measurement of dielectric constant, influence of solvent on polarisation, and value of atomic polarisation. With regard to interpretation, the discussion will centre around moments of individual links, dipole association, determination of valency angles, and a consideration of special structures, e.g., (a) benzene and electromeric effect and (b) azides.

At the inaugural meeting the president of the Faraday Society (Dr. N. V. Sidgwick, F.R.S.) will introduce the distinguished overseas members and visitors individually to those present. Distinguished foreign guests will be entertained at dinner on Thursday, April 12.

The reports and discussions will be published in the "Transaction of the Faraday Society," on September 1, 1934, and will subsequently be available as a separate limp cloth-bound reprint. Contributions to the discussion should be received by the secretary of the Faraday Society not later than May 1.

The provisional list of papers includes Dr. A. E. van Arkel (Eindhoven) on "Dipole Moments and Cohesion," Dr. A. E. van Arkel and Dr. J. L. Snoek (Eindhoven) on "The Dielectric Behaviour of Concentrated Solutions of Dipole Substances," Professor G. M. Bennett (Sheffield) on "The Valency Angles of Oxygen and Sulphur," Dr. E. Bretscher (Zürich) on "The Temperature Variation of the Dielectric Constant of Ionic Crystals," Professor P. Bebye (Leipzig) on "Energy Absorption in Dielectrics with Polar Molecules," Dr. F. Fairbrother (Manchester) on "The Dipole Moments of Halogen Hydrides in Solution," Professor P. Girard (Paris) on "Dipole Associations in Pure Liquids," Dr. H. O. Jenkins (Oxford) on "The Temperature Solution Method and the Atomic Polarisation," Dr. A. R. Martin (Aberdeen) on "Dipole Moment and Association of Liquids," Professor F. Horst Müller (Leipzig) on "Influuence of the Solvent on Dipole Moments," Professor W. H. Rodebush (Illinois) on "Dipole

Moment and Ionic Binding," Professor C. P. Smyth (Princeton) on "Dipole Inductive Effect and the Moments of Individual Links," Professor S. Sugden (London) on "Atomic Polarisation," Dr. A. Weissberger (Oxford), on "Limitations to the Calculation of Molecular Structures by Means of Group or Bond Moments," and Professor J. W. Williams (Wisconsin) on "Molecular Association and Compound Formation in Solution."

Society of Glass Technology

A Study of Volatilisation from Glasses

A MEETING of the Society of Glass Technology was held in Sheffield on February 21, the president, Mr. G. V. Evers, being in the chair.

A study of volatilisation from lithium oxide-containing glasses was presented by Dr. E. Preston and Professor W. E. S. Turner. Dr. Preston stated that the glasses used in this investigation were pure, having been melted in platinum. The initial rates of volatilisation at 1,400° ranged from 2.25 mg./cm.$_2$/20 hours for a 10.22 per cent. Li_2O glass, to 41.0 mg./cm.$_2$/20 hours for a 38.22 per cent Li_2O glass. Because of the great devitrification power of these mixtures it was possible, during the course of the work to give a visible demonstration of the changing surface concentration of alkali as volatilisation proceeded, and of the existence of a concentration gradient throughout the melt. For glasses containing 21 molecular per cent. of the oxides K_2O, Na_2O or Li_2O it was found that molecularly, these constituents were almost equally volatile at 1,400°. The non-volatility of silica in air up to temperatures of 1,400° was also demonstrated. It was deduced that the change-over at the glass surface from $2Li_2O : SiO_2 + Li_2O : SiO_2$ to $Li_2O : SiO_2 + Li_2O : SiO_2$ should occur after 12.90 hours heating. From the experimental results this change-over appeared to take place at about 13.5 hours.

The glass industry of Scandinavia was the subject of a paper by Professor W. E. S. Turner, who visited Scandinavia as recently as last autumn. He introduced this subject by reference to the high standard of the art of glassmaking which, in the past generation, had been attained in Sweden. It was shown that Sweden enjoyed no advantage over this country, for she had to import almost all raw materials. The pot furnaces used were of the recuperative type. Melting was done at night, the glass being worked out by day. Some factories made their own refractories, and the same complaints were made in the lead glass industry, as here. Pots were of the open type, even when full crystal was made. Up-to-date equuipment had been installed in many works, particularly those making bottles where Hartford-Fairmont lehrs were in operation along with older types.

Society of Dyers and Colourists

Huddersfield Section : Neolan Colours

A LECTURE on "Neolan Colours" was delivered to the Huddersfield Section of the Society of Dyers and Colourists, by Dr. T. A. Forster, of the Clayton Aniline Co., Ltd., on February 20.

The Neolan colours, said Dr. Forster, represents a new departure from ordinary chrome colours owing to the fact that they are chrome complexes of organic dyestuffs which may be applied directly to wool from a sulphuric acid dyebath. The old-established "on-chrome," "afterchrome," and "metachrome" processes all possess definite advantages from the point of view of producing fast shades on wool, but in many cases complete satisfaction is not obtained owing to difficulties of levelling and shading. A study of chrome colour dyeing shows that development has followed the lines of bringing the chrome and dyestuff molecules together in the dyebath and the final step is reached by the introduction of the Neolan range as the chrome is actually present in the dyestuff molecule itself.

The colours are applied from a sulphuric acid dyebath, and when so dyed the shades possess outstanding fastness properties as regards light, washing, perspiration, salt water, and light milling, whilst the spinning properties of slubbing are impaired to a less extent than when using chrome colours. Large quantities are employed for dyeing piece goods. Owing to their good solubility and fastness properties these colours are also well adapted for cheese and hank yarn dyeing in Hussong machines. Neolan dyed yarns are utilised as coloured stripes in blazer cloths as well as shirting materials and unquestionably the carpet trades favour the range for ships, hotels, railways, and theatre carpets, as experience has demonstrated their suitability over a long period. Likewise, upholstery in railway carriages and public buildings contain Neolan dyed yarns, as they withstand wet cleaning without alteration. Knitting yarns used in house and bathing costumes are advantageously dyed with the series in order to withstand washing, sea-water, perspiration, and wear.

The fact that selected colours discharge to a pure white hydrosulphite opens up the possibility of increasing the piece dyers' scope of business since a complete range of discharge styles may be produced. Besides the production of fast shades on all classes of wool, the Neolan colours dye real silk (weighted and unweighted), leather in fast shades for gloves, and high-class shoes, and high quality fur felt hats, with complete satisfaction. A considerable quantity of wool in the form of slubbing, yarn and piece is also printed with Neolan colours, as the prints possess excellent fastness properties, and in the case of slubbing the material is left in a better condition for spinning, due to the absence of excess chromium salts.

Leather Trades' Chemists

British Section

THE March meeting of the British Section of the International Society of Leather Trades' Chemists will be held in the Leather Industries Department, the University, Leeds, on Saturday, March 10, at 10 a.m. A report from the section sub-committee on *pH* Value of Tannin Extracts will be presented by Dr. Burton. Among the papers to be read are:—"Some Analyses and their Practical Significance" (Dr. D. Burton); "Unhairing Action of Amines" (Dr. R. H. Marriott); "Some Notes on the Constitution and Properties of Chebulinic Acid" (Dr. Goldman and Mr. F. C. Thompson), "The Deterioration of Vegetable Tanned Leather" (Mr. D. Woodroffe); "The Effect of Iron in the Deterioration of Vegetable Tanned Leather and its Inhibition by Rochelle Salt" (Mr. R. F. Innes); and "Hydrolysis of Chromium Sulphate Solution in relation to the Chrome Tanning Process" (E. Chollet and W. R. Atkin).

Midland Metallurgical Societies

Age-Hardening in Copper Alloys

THE phenomenon of age-hardening has only been examined during the last ten or twelve years, and unanimity has not yet been obtained as to the reason why alloys age harden, said Dr. Maurice Cook, at a meeting of the Midland Metallurgical Societies on February 13. Age-hardening indicates changes in properties which take place at room temperatures, but ageing is not the correct term for a change which gives improvements in properties. The terms "dispertion hardening" and "precipitation hardening" are also used, but they are not altogether justified. The term "temper hardening" seems to meet the case so far as the copper alloys are concerned, for it indicates hardening which takes place, but does not attempt to indicate the mechanism of the change.

In some cases age-hardening does not occur until after a certain period of time has elapsed, and in some cases hardening is accompanied by precipitation of the hardening constituent, but with alloys of copper, nickel and aluminium, hardening may occur without any visible change in the microstructure. The hardening constituent is then usually harder than the matrix, but instances are on record of alloys which harden less than would be expected, and vice versa. Ageing can be retarded or accelerated by the addition of other ele-

ments, and the reason for this is not fully understood. The general theories of ageing which have been put forward during recent years have dealt with duralumin alloys, but little work has been done on copper alloys. The precipitation theory supposes that hardness is due to the precipitation of a compound $CuAl_2$, the precipitated particles acting as keys on the slip bands and so preventing distortion of the whole. Another theory suggests that knots or groups of atoms collect, which are supposed to be able to resist deformation, but there is very little evidence to prove this theory.

As regards the copper alloys, there are many systems which are more or less age-hardening, or have similar properties. The copper-cobalt system is a typical age-hardening one, and the copper-chromium system is another. Copper-aluminium-manganese alloys with 9 per cent. of aluminium and 5-13 per cent. manganese can be hardened by quenching, at a suitable temperature. In the copper-magnesium-tin system the compound Mg_2Sn seems to be the hardening agent. There is a wide range of alloys of the copper-nickel-tin system, which are hardened by heat treatment, and copper alloys with silicon additions give rise to a type of hardenable alloys. They have not given the results which might have been expected, but with other additions a very useful series has been obtained. Silicon added to copper-manganese alloys produces hardening effects and improvements in properties, and 0.68 per cent. of silicon added to cupro-nickel increases the tensile strength from 27 tons per sq. in. to 51 tons per sq. in.

The Physical Society

Annual General Meeting

THE annual general meeting of the Physical Society will be held at the Imperial College of Science and Technology, South Kensington, S.W.7, on Friday, March 16, at 5 p.m., when officers and council for 1934-35 will be elected. The presentation of the eleventh Duddell Medal will also take place.

Hull Chemical and Engineering Society

Manufacture of Solvents from Ethanol

DEALING with the manufacture of solvents from ethanol in a lecture to the Hull Chemical and Engineering Society on February 20, Mr. E. C. Craven admitted that the term "solvents" like most other chemical terms, was incapable of precise definition.

By means of lantern slides the lecturer described the processes carried out at Salt End from the arrival of the ethanol from the Hull distillery to its final transformation into acetone, acetic acid and butanol. As intermediate steps in the manufacture, the processes employed in the production of acetaldehyde, aldol and crotonaldehyde were described. Mention was also made of hexadienals and octatrienals which had been isolated from the higher boiling fractions of the crotonaldehyde. It was explained that in the hydrogenation of crotonaldehyde to butanol (in which hydrogen produced as a by-product of the acetone plant is employed) these higher olefinic aldehydes give rise to higher alcohols of two kinds—normal primary and primary with an ethyl side group, the latter predominating. Methods may ultimately be discovered for so directing aldol condensations that only the more valuable normal alcohols result.

Brief mention was made of various derivatives including paraldehyde and diacetone alcohol, which are manufactured in addition to the three main products, and allusion was made to the immense range of esters distilled at the company's Carshalton factory. As a point of some interest it was pointed out that the entire processes at Hull were carried out without any substantial consumption of chemicals, very small additions of alkali or acid to regulate *pH* values being all that was required in most cases. For the determination of *pH* values, a mirror drum comparator has been devised for matching indicator colours with a minimum number of glass colour standards.

Institute of Fuel

North Western Section: Pulverised Fuel

AN address on pulverised fuel, with special reference to its use in Lancashire boilers, was given by Captain J. G. Bennett at a meeting of the North-Western Section of the Institute of Fuel, held at the Engineers' Club, Manchester, on February 21, under the chairmanship of Mr. E. Watson Smyth.

Introducing his subject with a brief survey of the theoretical aspects of the combustion of finely-divided coal, Captain Bennett pointed out that any attempt to attain ultra-fine dimensions of the fuel by means of present-day technique would involve an excessive consumption of power, whilst the existing types of mills would also tend to produce coalescence if the material were pounded for a long time. After stating that the satisfactory combustion of pulverised coal in the limited volume of a Lancashire boiler fire tube necessitated some form of turbulence, the author remarked that the economic burning of this type of fuel in a limited space involved several conditions. In the first place there must be a thorough and uniform dispersion of the coal-dust particles in the combustion air; secondly, a relative motion of coal particles to the air is necessary to ensure an adequate supply of oxygen for combustion; thirdly, a violent rotary motion must be avoided to prevent the gases being thrown against the walls of the combustion chamber; and fourthly, the velocity of the gases must be kept as low as possible, consistent with the prevention of back-firing, in order to give time for combustion to be completed.

Captain Bennett then described the operation of a burner, the efficiency of which had been established. Finally, he discussed the distribution and consumption of pulverised fuels, both at home and abroad, pointing out that, whilst this country consumed barely 3¾ million tons in 1932, the annual consumption in the United States and Germany was about 30 million tons and 6 million tons respectively. Centralised installations for preparing the fuel and the facilities for distribution were largely responsible for the relatively high consumption in the United States and Germany, and it was probable that a similar scheme, which was now in operation in this country, would prove beneficial to all concerned.

Society of Chemical Industry

Newcastle Section: Trend of Chemical Industry

THE present and probable future trend of chemical industry was the subject of an address delivered to the Newcastle Section of the Society of Chemical Industry on February 23. Tracing briefly the rise of modern industry, Mr. C. J. T. Cronshaw, director of the Dyestuffs Section, I.C.I., Manchester, made the point that the main objective of the manufacture of bulk quantities did not really change at the industrial revolution, but that it must change to-day. The manufacturer has found it only too easy to manufacture large outputs cheaply and profitably, which invites competition, until we have everywhere a decline in the demands on mass production, and the additional demands are satisfied by new products such as rayon, nitrocellulose lacquer, and stainless steel. The manufacturer now must seek the multiplication and diversification of products, which he has distrusted in the past, and solve the problems of production for the smaller outputs. One effect of the small number of products available has been the transfer of power, and profit, from the manufacturer to the retail stores. In the chemical industry technical service and research will solve the problems. The former now occupies the atmosphere of aroma and bouquet that the latter did just after the war, but in its proper sphere and proportion it should remain important. The need of industrial research is that it should develop along special lines, for at present it remains as it was taken over from the universities, only bigger, and ultimately a new technique must be imposed. The solution of the problem will probably seem simple when it comes. One example is the enormous, unwieldy mass of literature in organic chemistry which is not yet made available in the way that sales statistics, for example, have been handled.

News from the Allied Industries

Safety Glass

FOLLOWING THE RETURN from America of Mr. Graham Cunningham, managing director of the Triplex Safety Glass Co., Major A. E. Phillips, the chairman, points out that the company has no interest whatever in any company manufacturing safety glass in America. Mr. Cunningham visited the leading safety glass manufacturers in America, and reports that there seems to be a rising demand for safety glass to be fitted throughout in all motor vehicles, especially in commercial motor cars and buses.

Artificial Silk

FOR THE FIRST TIME for about four years, Germany registered an export surplus of rayon in January, 1934. The surplus for the month was 153 metric tons, valued at Rm.118,000. In December, imports exceeded exports by 414 metric tons of a value of Rm.1,746,000. This improvement was largely due to the new import quota system, which became effective at the end of December, and which reduced imports of rayon to 75 per cent. of the 1931 level. As a result of the reduced offers of foreign rayon and the increases in domestic sales, which in January were the best since the end of 1931, the rate of activity of the German rayon makers has improved substantially. British rayon production in January amounted to 8.5 million lb., against 7.1 millions in December and 5.9 millions in January, 1933. Acetate production was somewhat restricted, but viscose was maintained at a high level.

NEGOTIATIONS ARE NOW IN PROGRESS for a re-organisation of the German Rayon Syndicate, which includes leading producers of Holland, Italy, France, Switzerland, and Belgium. The German producers hope to eliminate these producers from the syndicate in order to secure control of the home market. The German Government is about to open negotiations with the Government of Italy and with the rayon industries of Holland, France, Switzerland, and Belgium in order to get their consent for an increase of German import duties on foreign rayon and for a permanent reduction of the import quotas.

Cement

SPEAKING AT THE ORDINARY GENERAL MEETING of Oxford and Shipton Cement, Ltd., at Winchester House, London, on February 22, Viscount Dillon (the chairman of the company), said that since the issue of the report there have been signs of an improvement in price, but it is, as yet, too early to say whether a permanent improvement is likely. There are many reasons for anticipating an increase of consumption of cement this year, chiefly plans for slum clearance, water supplies, and continued house building.

Beet Sugar

THE MINISTRY OF AGRICULTURE has issued a memorandum on the financial resolution to provide for the continuance into next year of the beet sugar subsidy. The British Sugar (Subsidy) Act, 1925, under which subsidy on sugar and molasses manufactured from home-grown beet is at present payable, expires on September 30. The new financial resolution provides the authority for the continuance of this subsidy, subject to a modification regarding molasses, for a period of eleven months after September 30. It is proposed that the subsidy on sugar shall be at the same rates as those set out in the first schedule to the Act of 1925 for sugar manufactured between September 30, 1931, and October 1, 1934; that is to say, at the rate of 6s. 6d. per hundredweight of sugar of a polarisation exceeding 98 deg., and for sugars of lower degrees of polarisation at rates calculated on the basis of the scale already applied for the purpose of Customs duty. Regarding molasses, it is proposed that if the average market price per hundredweight of raw sugar for the last quarter of 1934, as certified by the Ministry of Agriculture and Fisheries, is less than 5s. 6d., subsidy will be payable at the rate set out in the first schedule ot the Act of 1925, that is to say, at 4s. 1.5d. per hundredweight for molasses containing 70 per cent. or more of sweetening matter, and for molasses of lower sweetening matter content at rates calculated on the basis of the scale already applied for Customs duty. It is estimated that the amount of subsidy payable under the Bill will be about £3,250,000.

Continental Chemical Notes

COAL TAR INTERMEDIATES, dyestuffs, medicinal chemicals and fatty acids (from petroleum), figure prominently among those branches of the Russian chemical industry which an official survey in the current issue of "Metallbörse" describes as having registered decisive progress.

* * *

A LOSS OF 66,825 MARKS, for the year 1932, is now revealed in the balance sheet which has just been published by the Deutsche Bergin A.-G., the wood hydrolysis concern. Experimental work was responsible for an expenditure of 430,000 marks.

* * *

ORGANIC IMPURITIES can readily be eliminated from kieselguhr by an ignition process. According to Liesegung ("Angewandte Chemie," 1934, p. 48), this is conveniently effected on the large scale by stacking a layer of the material over a pile of burning brush wood when the kieselguhr begins to glow and continues to do so spontaneously owing to the high content of organic matter. As soon as the glow has spread through to the surface a fresh layer of crude kieselguhr is applied, and this operation is repeated until the pile grows to considerable dimensions (100 feet long by 15 feet wide by 6 feet high). Arrangements must accordingly be made for adequate ventilation, otherwise the kieselguhr itself may smoulder and so depreciate in value. Sintering is another danger which can be avoided by not allowing the temperature to exceed 800° C.

A NEW CASEIN FACTORY is expected to be in production at Saratov (Russia) during the present year.

* * *

A NEW TYPE OF POROUS MASS for dissolved acetylene containers, which has been officially approved in Prussia, is described as a mixture of wood-free peat "straw" (torfmull) and short animal hair. The mass is manufactured and filled into the acetylene containers by the firm of W. Geldbach, of Gelsenkirchen.

* * *

NEW LABORATORY APPARATUS described in the "Chemische Fabrik," of February 21, includes a power-driven gyroscopic device for automatic suppression of foam during vacuum distillation of badly foaming liquids; an automatic combustion scheme for semi-micro carbon and hydrogen estimation; and a new temperature regulator which, among other uses, has rendered exceptional service in the course of investigations on hydrogenation catalysts.

* * *

RECENT ADVANCES in the technique of mesothorium extraction from monazite sand, in which this radioactive element is present to the extent of 0.1 mg. in 25 kg., are reported in "Metallbörse," February 21. Improved methods have resulted in mesothorium production in Germany at a price per gram 90,000 marks below that of radium. Apart from the therapeutic value of mesothorium preparations, they appear to offer certain advantages over radium in the production of industrial luminous paints.

Inventions in the Chemical Industry

Specifications Accepted and Applications for Patents

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Accepted with Dates of Application

WETTING AGENTS, compositions containing.—Imperial Chemical Industries, Ltd., and W. Todd. Aug. 19, 1932. 406,001.

DESTRUCTIVE HYDROGENATION of distillable carbonaceous materials.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). July 7, 1932. 406,006.

VAT DYESTUFFS, manufacture and production.—J. Y. Johnson (I. G. Farbenindustrie). July 13, 1932. 406,008.

CONDENSATION PRODUCTS of the anthracene series, manufacture. A. Carpmael (I. G. Farbenindustrie). Aug. 9, 1932. 405,949.

PAINTS AND VARNISHES.—F. W. Skirrow and S. Whyte. Aug. 11, 1932. 405,986.

TREATMENT OF MINERAL SAND for the separation of one constituent therein from another.—M. A. Corbett. Aug. 12, 1932. 406,018.

BENZOL from distillation gas, production.—J. E. Pollak (Benzola Ges.). Aug. 15, 1932. 405,992.

PRODUCING COMPOSITIONS of fuel oil and powdered coal, process. Radiochemisches Forschungsinstitut Ges. Oct. 10, 1931. 406,067.

LACTIC ACID and its salts, production.—Bamag-Meguin Akt.-Ges. Dec. 7, 1931. 406,092.

OPIUM ALKALOIDS, more particularly from poppy plants, process for obtaining.—J. Kabay. Nov. 29, 1932. 406,107.

CONSISTENT GREASE in the cold state, process of manufacture.—G. J. C. Beckmann. March 23, 1933. 406,136.

GLASS WHICH RESISTS ATTACK by metal vapours.—Jenaer Glaswerk Schott and Gen. April 12, 1932. 406,142.

CONVERTING PHENOLIC BODIES and low-temperature tars into hydrocarbons, process.—Soc. des Carburants Synthetique. May 11, 1932. 406,151.

BENZOL from fuel distillation gas, production.—J. E. Pollak (Benzola Ges.). Aug. 15, 1932. 405,996.

AZO DYES, manufacture.—E. I. du Pont de Nemours and Co. May 27, 1932. 406,168.

MULTICELLULAR GLASS, process of manufacturing.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny, et Cirey.—June 22, 1932. 406,179.

FATTY ACIDS and the products resulting therefrom, method of distilling.—New Process Fat Refining Corporation. Dec. 1, 1932. 406,184.

CARDIO-ACTIVE GLUCOSIDES from digitalis lanata, process for the manufacture.—Chemical Works (formerly Sandoz). July 22, 1932. 406,197.

CONDENSATION PRODUCTS of the anthracene series, manufacture. A. Carpmael (I. G. Farbenindustrie). Aug. 9, 1932. 405,967.

MIXED ESTERS of polyhydric alcohols and resins and coating compositions manufactured therefrom, manufacture.—E. I. du Pont de Nemours and Co. April 8, 1932. 405,827.

ALIPHATIC ACIDS, method of preparing salts.—W. J. Tennant (Dow Chemical Co.). May 3, 1933. 405,846.

DIAZO TYPES, preparation.—Kalle and Co. Akt.-Ges. July 2, 1932. 405,880.

CELLULOSE ESTERS, manufacture.—Soc. of Chemical Industry in Basle. July 11, 1932. 405,884.

CARDIO-ACTIVE MATERIALS from the glucosides of digitalis and scilla, process for the manufacture.—Chemical Works formerly Sandoz. July 22, 1932. 405,890.

ELECTROLYTIC DEPOSITION of nickel from nickel salt solutions.—Falconbridge Nikkelverk Aktieselskap. Aug. 27, 1932. 405,902.

FAT-DISSOLVING MEDIUM, production of an aqueous emulsion.—W. H. Wilcken. Dec. 5, 1932. 405,906.

Complete Specifications Open to Public Inspection

STABILISING FATS and/or oils and the product resulting therefrom, methods.—Swift and Co. Aug. 15, 1932. 11370/33.

CYCLIC *α*-CYANKETIMIDES and cyclic *α*-cyanketones, process for the manufacture.—Schering-Kahlbaum Akt.-Ges. Aug. 15, 1932. 21991/33.

CALCIUM FORMATE, production.—R. Koepp and Co. Chemische Fabrik Akt.-Ges. Aug. 13, 1932. 21993/33.

ARTIFICIAL AGEING of alcoholic liquors and perfumes.—Oligodyn Akt.-Ges. Aug. 16, 1932. 22928/33.

SOAP MANUFACTURE.—E. I. du Pont de Nemours and Co. Aug. 18, 1932. 23132/33.

ETHYL ACETATE from ethyl alcohol, catalytic manufacture.—E. J. du Pont de Nemours and Co. Aug. 18, 1932. 23133/33.

IMMUNISATION of seed grain and the like.—E. I. du Pont de Nemours and Co. May 26, 1931. 5419/33.

Applications for Patents

VAT DYESTUFFS, manufacture.—A. Carpmael and I. G. Farbenindustrie. Feb. 13. 4790.

ALKYL SULPHONIC ACIDS, manufacture.—A. Davidson and Imperial Chemical Industries, Ltd. Feb. 13. 4786.

CONDENSATION PRODUCTS of phenols, etc., manufacture.—A. A. Drummond, Imperial Chemical Industries, Ltd., and H. H. Morgan. Feb. 12. 4660.

METAL-COATED MATERIALS, manufacture.—E. I. du Pont de Nemours and Co. Feb. 12. (United States, March 17, '33.) 4574.

BERYLLIUM ALLOYS, production.—Heraeus-Vacuumschmelze Akt.-Ges and W. Rohn. Feb. 14. (Germany, Feb. 17, '33.) 4906.

BERYLLIUM ALLOYS, production.—Heraeus-Vacuumschmelze Akt.-Ges. and W. Rohn. Feb. 14. (Germany, April 13, '33.) 4907.

BERYLLIUM ALLOYS, production.—Heraeus-Vacuumschmelze Akt.-Ges. and W. Rohn. Feb. 14. (Germany, Aug. 25, '33.) 4908.

PURE ZINC OXIDE, obtaining.—L. C. Humbert and E. Sterkers. Feb. 9. (France, Feb. 10, '33.) 4323.

WETTING, ETC., AGENTS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 8. 4226.

POLYNUCLEAR CARBON COMPOUNDS from bituminous substances, production, etc.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 8. 4227.

VINYL ETHERS, manufacture and production.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 10. 4471.

PROCESS for improving lubricating oils, etc.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 12. (Aug. 17, '32.) 4598.

UREA-FORMALDEHYDE CONDENSATION PRODUCTS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 12. 4599.

BENZONE, HYDROCARBONS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 12. 4600.

LUBRICATING GREASES, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 13. (Oct. 15, '32.) 4747.

PRODUCTS similar to lubricating oils, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 13. (Oct. 20, '32.) 4748.

IMPROVING OILS.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 13. (Dec. 13, '32.) 4749.

HYDROCARBON MIXTURES.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 13. (Dec. 13, '32.) 4750.

HYDROCARBON MIXTURES, improving.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 13. (Dec. 13, '32.) 4751.

HYDROCARBON PRODUCTS, and manufacture of same.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 13. (June 6, '33.) 4752.

FATTY ACIDS, ETC., recovery.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 14. 4887.

WETTING, ETC., AGENTS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 14. 4888.

MANUFACTURE of 5-pyrazolone derivatives.—I. G. Farbenindustrie. Feb. 8. (Germany, Feb. 8, '33.) 4208.

OXAZINE DYESTUFFS, manufacture.—I. G. Farbenindustrie. Feb. 10. (Germany, Feb. 10, '33.) 4480.

MATERIAL comprising a polymeride in sheet form, manufacture. Imperial Chemical Industries, Ltd. Feb. 12. 4661.

DESTRUCTIVE HYDROGENATION of carbonaceous materials, etc.—International Hydrogenation Patents Co., Ltd. Feb. 10. (Germany, March 24, '33.) 4456.

CHLORINATED RUBBER, manufacture.—Imperial Chemical Industries, Ltd. and T. N. Montgomery. Feb. 13. 4787.

DESTRUCTIVE HYDROGENATION of carbonaceous materials, etc.—International Hydrogenation Patents Co., Ltd. Feb. 10. (Germany, April 29, '33.) 4457.

DESTRUCTIVE HYDROGENATION of carbonaceous materials, etc.—International Hydrogenation Patents Co., Ltd. Feb. 10. (Germany, May 18, '33.) 4458.

SULPHURIC ACID, production.—Metallges Akt.-Ges. Feb. 14. (Germany, Feb. 15, '33.) 4957.

CYCLIC 1-2 AMINO KETONES, manufacture.—P. W. Neber. Feb. 13. (Germany, Feb. 13, '33.) 4799.

SYNTHETIC PREPARATION of urea.—J. M. J. Rochet. Feb. 8. 4212.

SIMULTANEOUS MANUFACTURE of urea and ammoniacal salts.—J. M. J. Rochet. Feb. 13. 4755.

DYEING, etc., vegetable fibres.—Soc. of Chemical Industry in Basle. Feb. 9. (United States, Feb. 9, '33.) 4377, 4378.

DYEING with direct dyestuffs.—Soc. of Chemical Industry in Basle. Feb. 9. (United States, Feb. 9, '33. 4379.

CHROMIFEROUS AZO DYESTUFFS, manufacture.—Soc. of Chemical Industry in Basle. Feb. 13. (Switzerland, Feb. 21, '33.) 4758.

CHROMIFEROUS AZO DYESTUFFS, manufacture.—Soc. of Chemical Industry in Basle. Feb. 13. (Switzerland, Feb. 22, '33.) 4759.

WATER-SOFTENING APPARATUS.—D. Thomas and Thomas and Clement, Ltd. Feb. 14. 4959.

PURIFICATION of phosphoric acid.—Victor Chemical Works. Feb. 13. (United States, May 4, '33.) 4779.

CONCENTRATION of sulphuric acid.—M. F. Acken and E. I. du Pont de Nemours and Co. Feb. 20. 5580.

CATALYTIC HEATING APPARATUS.—A. Arduino. Feb. 19. (France, Feb. 17, '33). 5381.

CELLULOSE ESTERS, treatment.—H. A. Auden, Distillers Co., Ltd., and H. P. Staudinger. Feb. 16. 5214.

SUBSTITUTE for celluloid.—H. A. Auden, Distillers Co., Ltd., and H. P. Staudinger. Feb. 21. 5740.

HALOGENATED DYESTUFFS, manufacture.—A. Carpmael and I. G. Farbenindustrie. Feb. 15. 5071, 5072.

AMINOALKYLATED AMINES, manufacture.—A. Carpmael and I. G. Farbenindustrie. Feb. 17. 5311.

QUATERNARY AMMONIUM COMPOUNDS, manufacture.—A. Carpmael and I. G. Farbenindustrie. Feb. 20. 5605.

SEPARATION of arsenic and antimony from complex sulphur compounds of copper.—H. Cmyrol. Feb. 21. (Austria, Feb. 21, '33). 5771.

CONVERSION of gases into new substances.—F. B. Dehn, Bellas Processing Corporation. Feb. 19. 5504.

HYDROGEN PEROXIDE, production.—Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler. Feb. 19. (Germany, Aug. 14, '33). 5477.

AMMONIUM SULPHATE, production.—Directie van de Staatsmijnen in Limburg. Feb. 15. (Holland, Oct. 16, '33). 5095.

STABILISATION of aqueous solutions containing hydrogen peroxide.—E. I. du Pont de Nemours and Co., H. N. Gilbert and J. S. Reichert. Feb. 15. 5098.

CYCLIC ESTERS, manufacture.—E. I. du Pont de Nemours and Co. (Feb. 19. (United States, Feb. 18, '33.) 5422.

SODIUM, etc., production.—E. I. du Pont de Nemours and Co. Feb. 19. (United States, Feb. 17, '33.) 5423.

ALCOHOLS, production.—H. D. Elkington and Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Feb. 20. 5643.

BITUMINOUS DISPERSIONS, manufacture.—W. W. Groves and I. G. Farbenindustrie. Feb. 16. 5221.

HORMONES of suprarenal cortex, manufacture.—W. W. Groves, and I. G. Farbenindustrie. Feb. 19. 5439.

ESTERS of fatty-aromatic acids with aminoalcohols.—Hoffman-La Roche and Co. Feb. 15. (Germany, July 6, '33.) 5013.

POLYMERISING monomeric aldehyde sugars.—Holzhydrolyse Akt.-Ges. Feb. 16. (Germany, Feb. 16, '33.) 5246.

ORGANIC SUBSTANCES, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 15. 5094.

MIXTURES OR DISPERSIONS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 19. 5443.

VINYL ETHERS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 19. 5444.

ALCOHOLS of high molecular weight, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 21. 5713.

ALKYLATED ACENAPHENS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. Feb. 21. 5714.

ETHYLENE AZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. Feb. 16. (Germany, Feb. 16, '33.) 5235.

MAGNESIA from dolomite, production.—I. G. Farbenindustrie. Feb. 19. (Germany, March 13, '33.) 5479.

DEGREASING APPARATUS.—Imperial Chemical Industries, Ltd. Feb. 15. 5100.

REDUCING FATTY ACIDS, etc.—Imperial Chemical Industries, Ltd. Feb. 16. 5216.

GRANULATED anhydrous sodium peroxide. G. F. Jaubert. Feb. 20. (France, Feb. 20, '33.) 5630.

PRODUCTION of carbon dioxide, apparatus.—G. Maiuri and Maiuri Refrigeration Patents, Ltd. Feb. 20. 5579.

HALOHYDRINS, manufacture.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Feb. 21. (United States, Feb. 27, '33). 5780.

PRODUCTION of ferro-chromium free from carbon.—Norsk Hydro-Elektrisk Kvaelstofaktiescelskab. Feb. 21. (Norway, April 16, '33.) 5733.

WATER-SOLUBLE ORGANIC SILVER COMPOUNDS, manufacture.—K. Roth. Feb. 20. (Germany, Feb. 22, '33.) 5639.

WATER-SOLUBLE ORGANIC SILVER COMPOUNDS, manufacture.—K. Roth. Feb. 20. (Germany, Feb. 22, '33.) 5640.

TREATMENT OF LATEX.—Rubber Research Institute of Malaya and Rubber Producers' Research Association. Feb. 19. 5411.

TITANIUM COMPOUNDS, production.—Titan Co., Inc. Feb. 16. (United States, Feb. 24, '33.) 5241.

Chemical Market Conditions

Price Changes

MOST industrial chemicals have met with a satisfactory demand during the week, and prices have been well maintained. Active interest has been shown in acetic acid, acetone, anhydrous ammonia, formaldehyde, oxalic acid and salammoniac. Japanese competition has affected the arsenic market, and zinc oxide, sodium nitrite and sodium sulphide are dull items. Large orders have been placed in the coal tar products section for refined coal tar for the coming season, and there has been an improvement in the pitch market. In the pharmaceutical section there has been an increase in the price of cream of tartar. Prices of all chemical products remain as quoted in THE CHEMICAL AGE of February 17 (pages 150-151) with the exceptions noted below.

LONDON.—London markets have proceeded on quietly steady lines with a fair average volume of business being transacted. Prices are practically unchanged and remain firm. The coal tar products market continues to be firm, and prices are unaltered from last week.

MANCHESTER.—Most sections of the chemical market in the Manchester district during the past week have continued to reflect steady to firm conditions, and the products where any degree of price uncertainty is in evidence have been those tied up with the movements of the metal markets. The lead compounds, however, as they have been during the past month or so, have remained reasonably steady, but the weakness in the copper markt continues to react on sulphate values. Business generally during the past week has included a little contract buying of the leading heavy materials, but most buyers have been content to restrict commitments to deliveries over the next month or so. Delivery specifications, however, have been up to the aggregate volume of recent weeks and sellers have not a great deal of which to complain in this respect. In the by-products market there has been little fresh change in values since last report, though the tendency of crude tar seems to be towards still lower levels.

SCOTLAND.—Business continues to be steady in the Scottish heavy chemical market, but no outstanding contracts or business is being placed.

General Chemicals

LEAD, ACETATE.—LONDON: White, £34 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £33 to £35; brown, £1 per ton less. MANCHESTER: White, £34 to £36; brown, £31 10s.

POTASH, CAUSTIC.—LONDON: £42. MANCHESTER: £38.

SULPHATE OF COPPER.—MANCHESTER: £15 10s. per ton f.o.b.

Pharmaceutical and Fine Chemicals

POTASSIUM BITARTRATE (Cream of Tartar).—99/100%, 82s. per cwt.

Coal Tar Products

ACID, CARBOLIC.—Crystals, 8½d. to 8¾d. per lb.; crude, 60's 2s. 1½d. to 2s. 2½d. per gal. MANCHESTER: Crystals, 9d. per lb.; crude, 2s. 5d. per gal. SCOTLAND: 60's, 2s. 6d. to 2s. 7d.

ACID, CRESYLIC.—90/100%, 1s. 8d. to 2s. 3d. per gal.; pale, 98%, 1s. 6d. to 1s. 7d., according to specification; refined, 1s. 11d. to 2s. 1d. LONDON: 98/100%, 1s. 3d.; dark, 95/97%, 11d. SCOTLAND: Pale, 99/100%, 1s. 3d. to 1s. 4d.; 97/99%, 1s. to 1s. 1d.; dark, 97/99%, 11d. to 1s.; high boiling acid, 2s. 6d. to 3s.

Wood Distillation Products

ACETATE OF LIME.—Brown, £9 to £10. Grey, £16 to £17. Liquor, brown, 30° Tw., 7d. to 9d. per gal. MANCHESTER: Brown, £12; grey, £17.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—Home, £7 5s. per ton; export, nominal, £5 17s. 6d. f.o.b. U.K. ports in single bags.

CYANAMIDE.—£7 5s. per ton, carriage paid to railway station.

Books Received

Text-Book of Inorganic Chemistry for University Students. By J. R. Partington. London: Macmillan & Co., Ltd. Pp. 1062. 15s.

The Progress of Science. By J. G. Crowther. London: Kegan Paul, Trench, Trubner & Co., Ltd. Pp. 304. 12s. 6d.

Official Publications Received

Bulletin of the Imperial Institute. Vol. XXXI. No. 4. 1933. London: John Murray. Pp. 160. 3s. 6d.

From Week to Week

MR. HAROLD NOLAN, M.D., LL.D., F.I.C., sometime of Cairo and New York, and late of London, died on February 22, at Guildford.

COLONEL SIR FREDERIC LEWIS NATHAN, of 37 Cromwell Gardens, London, S.W., president of the Institute of Chemistry, 1925 to 1927, who died on December 10, left estate of the gross value of £28,377 (net personalty £28,074).

THE MINERS' FEDERATION OF GREAT BRITAIN has issued a statement advocating a national fuel policy, having for its object the elimination of foreign oil, and the creation of a great fuel production and treatment industry based on British coal.

A FIRE AND EXPLOSION caused by a leakage of gas occurred at the Billingham works of Imperial Chemical Industries, Ltd., on February 21, but, although the force of the explosion was felt some distance away, little damage was done. One man was slightly cut by falling glass, but remained at work.

MR. ROBERT FORRESTER, who presided at the opening of an exhibition of coal-burning appliances promoted by the Coal Utilisation Council in Glasgow, on February 22, said that "from a national point of view it is of much importance that we should develop and use our own natural fuel resources in preference to importing fuel from abroad."

INTERNATIONAL COMBUSTION, LTD., Grinding, Screening and Filtering Division, report amongst recent orders a 6 ft. × 36 in. Hardinge Ball Mill for grinding coal; two 5 Roller Raymond Mills, 14 ft. and 16 ft. Rayco Separators for grinding and separating Gypsum; No. 3 "Impax" Pulveriser for bituminous coal; two No. 00 Raymond Pulverisers for grinding magnesia carbonate; and a 4 ft. 6 in. dia. Raymond Separating Plant for amorphous silica.

THE STURTEVANT ENGINEERING CO., LTD., have just received a repeat order from the North Metropolitan Power Station Co., Ltd., for an electrostatic precipitator for the Brimsdown station. This order has been received only a little over a year from the instructions to proceed on the first precipitator. One feature of these Sturtevant electrostatic precipitators is that it is very seldom, if ever, necessary to clean either the discharge or receiving electrodes by hand, as the type of rapping gear provided by this firm is so efficient that the electrodes are always kept free from dust.

DAMAGE ESTIMATED AT £2,000 was caused by a fire which broke out at the works of James Ferguson and Sons, Ltd., synthetic resin and ebonite manufacturers, Princes Road, Mitcham, on February 22. While six men were at work in a corrugated iron building a magnetic separator fused and ignited a quantity of bags containing ebonite dust. The flames spread to the filtration room adjoining, the roof of which partly collapsed. The six men escaped, but one received burns to the hands in trying to extinguish the flames.

THERE WERE VERY FEW AMENDMENTS in the agenda when the House of Commons Standing Committee, presided over by Mr. T. Cape (Workington), resumed consideration of the British Hydrocarbon Oils Production Bill, on February 22. The main object of the measure is to provide for a preference in respect of light hydrocarbon oils manufactured in the United Kingdom from coal, shale, or peat indigenous to the United Kingdom or from products produced from those substances. It also provides for the collection of information as to the production of those oils. The Committee stage of the Bill was completed and the measure ordered to be reported to the House.

A JOINT MEETING of the Chemical Engineering Group, the Diesel Engine Users' Association, the Institute of Fuel, the Institute of Marine Engineers, the Institution of Automobile Engineers, the Institution of Mechanical Engineers, the Institution of Petroleum Technologists, the Junior Institution of Engineers, the North-East Coast Institution of Engineers and Shipbuilders, the Royal Aeronautical Society, and the Society of Engineers, will be held in the Hall of the Royal Geographical Society, Exhibition Road, London, S.W.7, on Tuesday, March 6, at 7.30 p.m., when Mr. G. D. Boerlage and Dr. W. J. D. van Dyck will read a paper entitled, "Causes of Detonation in Petrol and Diesel Engines." The paper will be followed by a discussion.

THE LIFE OF CHARLES MACINTOSH, the Glasgow chemist who invented the process of waterproofing fabrics with rubber, was the subject of an address delivered to the Royal Philosophical Society of Glasgow, by Professor G. G. Henderson, on February 21. Professor Henderson said that Macintosh contracted with the proprietors of the Glasgow Gas Works for their output of tar and ammoniacal liquor in 1819. The tar he distilled because there was a good demand for the residual pitch. It occurred to him that if that volatile part of the liquid distillate known as naphtha would dissolve rubber he could succeed, by evaporation of the solution, in depositing a flexible film of rubber between two layers of fabric and in 1822 he obtained a patent for his process and established factories in Glasgow and Manchester.

MANGIN DAVSON AND PARTNERS, LTD., have been obliged to move to larger offices at 54 Victoria Street, S.W.1. Their telephone numbers, Victoria 1752-3-4, are not changed.

THE RE-OPENING of Pullar's Tulloch dyeworks, the closing of which towards the end of December threw about 400 employees out of work, is promised within a fortnight.

BEFORE OPENING the new Tees (Newport) bridge at Middlesbrough on Wednesday, the Duke of York motored to Billingham and spent an hour at the works of Imperial Chemical Industries, Ltd.

GOOD PROGRESS IS BEING MADE with the £45,000 extension scheme of the Scottish Dyes factory at Earl's Road, Grangemouth, West Lothian. The heavy machinery is to be installed by Sir William Arrol and Co., Glasgow, who are also the contractors for the steelwork construction.

WE HAVE RECEIVED from the Feedwater Specialists Co., Liverpool, an attractive two-year wall calendar, illustrating outstanding events in the development of engineering and giving much valuable tabulated information for use in connection with boiler maintenance and efficiency.

THE GERMAN AMMONIA SALES ORGANISATION, of Bochum, has been extended until 1940. Only six companies are now outside the combine, but negotiations with them are said to be promising. Recently the German Government prohibited the establishment of new nitrate plants or the extension of existing ones.

SIR WILLIAM BRAGG delivered the first of a series of lectures on the elements of crystal analysis at the Royal Institution, on February 15. He stated that the theoretical development of the subject was held up by lack of information concerning the internal arrangement of the units and their nature. An experiment suggested by Laue (the German physicist) led to the realisation that such information could be obtained from the action of crystals upon X-rays. This was the starting-point of the new science.

SIR HARRY PERCIVAL DENSHAM, of Glewstone Court, Ross-on-Wye, Hereford, tanner, chairman of H. Densham and Sons, Ltd., Redcross Street, Bristol, and a director of British Tanners, Ltd., London, and other companies, including Pierpoint and Bryant, Warrington, chairman of William Mortimer and Co., Ltd., the Orford Tannery, Warrington, who died on November 17, aged 67 years, left estate of the gross value of £71,279 (net personalty £41,203).

SIR ALEXANDER WALKER told the Coal Industry Society at their luncheon at the Hotel Metropole, London, on February 26, that he was a great believer in the future of electricity and gas as alternative fuels to petrol. He predicted that our balance of trade would still be against us this year. The only importation he thought we could afford to cut down was fuel. The economic law would then force us to utilise our coal resources to much more effect than we had done in the past.

MR. M. G. P. WHELPLEY, President of the Lautaro Nitrate Co., left New York for England in the liner "Majestic," on February 23. He hopes to discuss with British nitrate interests the question of the reorganisation of the capital structure of Anglo-Chilean Consolidated Nitrate Corporation and Lautaro, pursuant to the Chilean Nitrate Reorganisation Law, under which Cosach is being liquidated and Anglo-Chilean and Lautaro are being withdrawn from the combination. Mr. Whelpley said that nitrate sales were responding to better world-wide conditions, and he was hopeful of a continuation of the upward trend.

STIRLING COUNTY COUNCIL have decided that it would be useless to make further efforts to induce Imperial Chemical Industries, Ltd., to reconsider their decision to close down Nobel's explosives works at Westquarter, Polmont, in order that the energies of the firm may be concentrated at Ardeer. A deputation representing the Council had a meeting with officials of I.C.I. at Westquarter, when it was explained that what had perforce governed the policy of the company in the matter was the pressure of world competition. Only by concentration and modernisation of their plant and lay-out could the firm have any chance of competing successfully with their foreign rivals.

REPRESENTATIONS HAVE BEEN MADE to the Board of Trade under Section 10 (5) of the Finance Act, 1926, for the exemption of gas generating apparatus known as "Kipp's Apparatus," from Key Industry Duty under Section 1 of the Safeguarding of Industries Act, 1921, as amended by the 1926 Act. The ground of the representations is that the apparatus is not made, and is not likely to be made, in any of the British Dominions in substantial quantities, having regard to the requirements of the United Kingdom. Communications on the subject should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, not later than March 25.

Forthcoming Events

Mar. 5.—The Chemical Society. "Recent Work on Molecular Structure." Dr. N. V. Sidgwick. 5.30 p.m. Chemistry Lecture Theatre, The University, Birmingham.

Mar. 5.—Society of Chemical Industry (London Section). "The Chemistry of Rubber Accelerators." Dr. W. J. S. Naunton. W. Baird and H. M. Bunbury. 8 p.m. Burlington House, Piccadilly, London.

Mar. 6.—Chemical Engineering Group and other Societies. "Causes of Detonation in Petrol and Diesel Engines." G. D. Boerlage and Dr. W. J. D. van Dyck. 7.30 p.m. Royal Geographical Society, Exhibition Road, London.

Mar. 6.—Hull Chemical and Engineering Society. "The Aesthetic Aspect of Engineering." T. Somerscales. 7.45 p.m. Grey Street, Park Street, Hull.

Mar. 7.—Society of Public Analysts. 8 p.m. Burlington House, Piccadilly, London.

Mar. 7.—Institute of Metals. Annual General Meeting. 10 a.m. Hall of the Institution of Mechanical Engineers, Storey's Gate, London. Annual Dinner and Dance. 7 p.m. Trocadero Restaurant, Piccadilly, London.

Mar. 8.—Society of Chemical Industry (Nottingham Section). "Tariffs and the Chemical Industry." J. Davidson Pratt. 7.30 p.m. University College, Nottingham.

Mar. 8.—Oil and Colour Chemists' Association. "The Rehabilitation of Natural Resins." W. Krumbhaar. 7.30 p.m. 30 Russell Square, London.

Mar. 9.—Oil and Colour Chemists' Association (Manchester Section). "Some Speculation on Paint." W. G. Sutherland. 7 p.m. The College of Technology, Manchester.

Mar. 9.—The Chemical Society (North Wales). "Film Reactions." Professor E. K. Rideal. 6 p.m. University College of N. Wales, Bangor.

Mar. 9.—Chemical Engineering Group. Road and Building Materials Group and the Institution of Structural Engineers. "Some Trends of Development in Building Materials." Major V. Lefebure. 8 p.m. Imperial Chemical House, London.

Mar. 9.—Institute of Metals (Sheffield Section). "Nickel-Chrome Plating." Frank Mason. 7.30 p.m. University, Sheffield.

Mar. 9.—Institute of Chemistry (Glasgow Section). Refresher Lecture in Physical Chemistry by J. A. Cranston. 7.30 p.m. Royal Technical College, Glasgow.

Mar. 10.—British Association of Chemists (London Section). Annual dinner. Palace Rooms, Palace Hotel, Bloomsbury Street, London.

Mar. 10.—International Society of Leather Trades' Chemists British Section). 10 a.m. Leather Industries Department, The University, Leeds.

Company News

Calico Printers' Association.—An interim dividend has been declared on the preference stock at the rate of 2½ per cent., less tax, for the half-year to December 31, 1933, payable on March 31.

Inveresk Paper Co.—The directors have declared a dividend at the rate of 6 per cent. per annum on the first preference stock in respect of the half-year ended December 31, 1933, payable on March 14.

Reckitt & Sons, Ltd.—The quarterly dividend and interest on the 4½ per cent. and 5 per lent. preference shares and 4 per cent. and 4¼ per cent. debenture stocks will, it is announced, be paid on April 3.

Salt Union, Ltd.—An ordinary dividend of 9 per cent. is announced for the year 1933. The allocation to contingencies account is raised from £20,000 to £30,000, and the amount carried forward is £9,000, compared with £15,867 brought in.

John Oakey & Sons.—The report for the past year shows an increase in profits from £36,805 to £40,815. A final dividend is recommended of 9½ per cent. on the ordinary shares, making a total of 12 per cent. for the year and a dividend of 12 per cent. on the issued employees' shares. The sum of £5,000 is transferred to general reserve and £4,880 carried forward.

Milton Proprietary Co.—For the fifteen months to December 31 last, the report shows a trading profit of £55,657. The directors recommend a final dividend on the ordinary shares of 10 per cent., making 15 per cent., and a bonus of 3¾ per cent., payable on March 5. The amount carried forward is raised from £41,991 to £66,823.

Delta Metal Co.—The report for the year 1933 shows balance of trading account £77,009, dividends from subsidiary companies £12,275, and registration fees £32, making £89,316 less directors' fees £7,097, auditors' fees £315, reserve for tax £17,500 and depreciation £16,394, leaving a net profit of £48,010, which with the balance brought forward makes a total of £62,204. The directors recommend a dividend of 12½ per cent., together with a bonus of 6d. per share, both free of tax, to reserve against premises, plant and installation £2,000, leaving to be carried forward £15,204.

New Companies Registered

British Eastern Phosphates, Ltd., 1 Gower Street, Bedford Square, London, W.C.1.—Registered as a "private" company on February 22. Nominal capital of 19,000 ordinary shares of £1 each and 20,000 deferred shares of 1s. each. To carry on all kinds of exploration business, etc. Directors: Albert E. Baker, Winnifred E. Wright.

British Smokeless and Oil Fuels, Ltd., 8 Princes Street, London, E.C.2.—Registered as a "private" company on February 22. Nominal capital £55,000. To adopt an agreement with the Millwall Syndicate, Ltd., and to carry on the business of distillers, extractors, producers, manufacturers and suppliers of all solid, liquid and gaseous substances, or matter in any form derived from coal, producers and manufacturers of and dealers in solid, liquid, and gaseous fuels for domestic, industrial and other purposes, tar, sulphate, and other forms of ammonia, oils, chemicals, etc. A subscriber: H. W. Brown, 63 Effingham Road, Lee, S.E.

Swallow Coal Distillation (Welbeck), Ltd., 40 Bank Street, Sheffield.—Registered February 12. Nominal capital £15,000. Distillers, refiners, manufacturers and suppliers of all solid, liquid and gaseous substances derived from mineral oil, petroleum, shale oils or any other hydrocarbon material, etc. Directors: John Swallow and Fredk. H. Brooke.

The Research Trust, Ltd., 4 Cleveland Square, St. James's S.W.1.—Registered as a private company on February 17. Nominal capital £15,750. To carry on the business of developers, researchers, managers, owners, licensees, investigators, financiers, consultants and promoters of or relating to any processes, projects, businesses, articles, formulae, methods, inventions or discoveries; chemists, experimenters and developers in regard to chemical and technical development, developers of chemical engineering, processes of all kinds, miners, mine owners, metallurgists, manufacturers, generators, suppliers and distributors of electricity, etc. A subscriber: George O. Mitchell, 21 Panton Street, London, S.W.1.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Portugal.—An agent established at Covilha wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of aniline dyes and accessories for the woollen industry. (Ref. No. 247.)

Argentina.—The Commercial Counsellor to the British Embassy at Buenos Aires reports that the Argentine National Sanitation Works Department is calling for tenders, to be presented in Buenos Aires, by March 22, 1934, for the supply of one rapid pressure filter, one Venturi and five Woltmann filters, 34 sterilising (chlorine) equipments (injection apparatus), 12 dosing equipments for alumino-ferric and hydrate of lime (silos and crushers also required) and eight filter control equipments. (Ref. G.Y. 13494.)

Argentina.—The Commercial Counsellor to the British Embassy at Buenos Aires reports that the Argentine State Oilfields Directorate is calling for tenders, to be presented in Buenos Aires by March 22, 1934, for the supply and delivery of 2,000 drums of extra mild steel plate, each capable of holding 400 litres of Diesel oil. (Ref. G.Y. 13501.)

Argentina and Uruguay.—A Buenos Aires firm of commission agents and importers wish to be placed in touch with United Kingdom manufacturers of moulding powder, with a view to representation. (Ref. 253.)

New Chemical Trade Marks

Opposition to the registration of the following trade marks can be lodged up to March 21, 1934.

Pyrobel. 545,232. Class 4. Raw, or partly prepared, vegetable, animal, and mineral substances used in manufactures, not included in other classes. Nobel Chemical Finishes, Ltd. October 11, 1933.

Vitretin. 546,411. Class 1. Chemical substances for use in the manufacture of vitreous enamels. James Davies, trading as N. Sinclair and Co., Clyde Colour and Chemical Works, Nile Street, Burslem, Staffordshire. November 23, 1933.

Vacsel. 547,797. Class 1. Salt used in the regeneration of water-softening plant. Silical Water Softeners, Ltd. "Silical House," 27 Moor Lane, London, W.C.2. January 16, 1934.

Gastex. 545,323. Class 1. Carbon black. General Atlas Carbon Co., 60 Wall Street, New York City, United States of America. October 13, 1933.

Fedal. 546,872. Class 1. Chemical substances used in manufacture, photography or philosophical research and anti-corrosives, but not including paints and not including any goods of a like kind to paints. H. Th. Böhme Aktiengesellschaft, 20 Moritzstrasse, Chemnitz, Saxony, Germany. December 6, 1933.

Voluntary Liquidation

Affairs of a Manchester Dyeing Firm

AT the statutory meeting of the creditors of James Currie, Ltd., dyers, etc., Manchester, an estimated statement of affairs was submitted which showed ranking liabilities of £158,687, due to unsecured creditors. According to the books, the assets totalled £102,963, and they were estimated to realise £12,214, or a deficiency so far as the creditors were concerned of £146,473. The assets consisted of cash in hand 19s. 7d.; good book debts £1,572 8s. 8d.; stock of stores and value of work in progress £661 17s. 6d., estimated to produce £450; rents accrued £91; motor £278 18s. 1d., expected to realise £100; machinery and plant £35,860 6s. 4d., put down at £3,000, and equity in property £64,010 0s. 11d., estimated to realise £7,000. The statement showed approximately 1s. 6d. in the £, subject to expenses and contingencies of liquidation. The issued capital of the company was £4,000, all fully paid. For some time past a loss had been sustained on the trading.

A resolution was passed confirming the voluntary liquidation of the company, with Mr. A. E. Jones, of Price, Waterhouse and Co., and Sir William McLintock, of Thomson, McLintock and Co., as joint liquidators, together with a committee consisting of representatives of the Imperial Chemical Industries, Ltd.; Sorsby and Co., Ltd., and Grant, Grierson and Co.

Leather Dyeing

Effect of Hydrogen Ion Concentration in Dyebath

IN the dyeing of vegetable tanned leather by means of acid dyestuffs, the depth to which penetration occurs varies according to the dyestuff used, and while some penetrate quite readily, others appear sadly lacking in this property. It is a common practice to add ammonium acetate to the dyebath with a view to increasing penetration. This it does by virtue of its buffer action, stabilising the effective acidity of the dyebath. This has led Dr. R. H. Marriott to study the effect of the *pH* of the dyebath when dyeing leather with the acid colours. (J.I.S.L.T.C., 1934, *18*, 92). It is shown that increase in penetration can be brought about by increasing the *pH* of the liquor, but that such increase is at the expense of the depth of shade. Further, after treatment of leather dyed in a bath at a high *pH* with acid does bring about a fuller shade, but the falling off is still apparent. Penetration of acid dyestuffs appears to be associated with the acid group of the dye. The stronger this group, the poorer the penetrating power.

IT is reported that the Mexican Zinc Co., S.A., has been granted a concession by the Federal Government to establish a zinc refinery and sulphuric acid plant at Saltillo. The total investment will involve 2,500,000 pesos.